SCIENTIFIC AMERICAN

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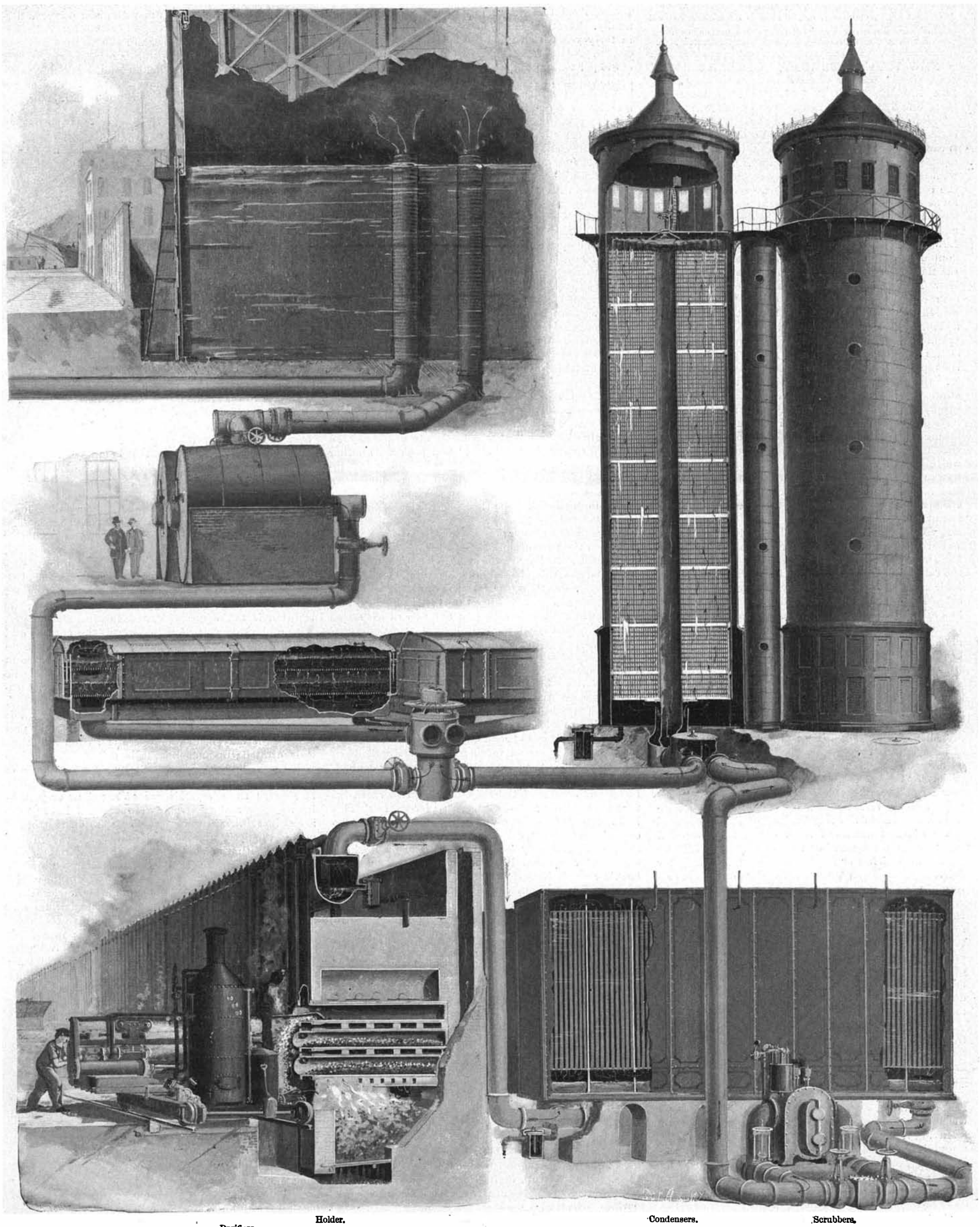
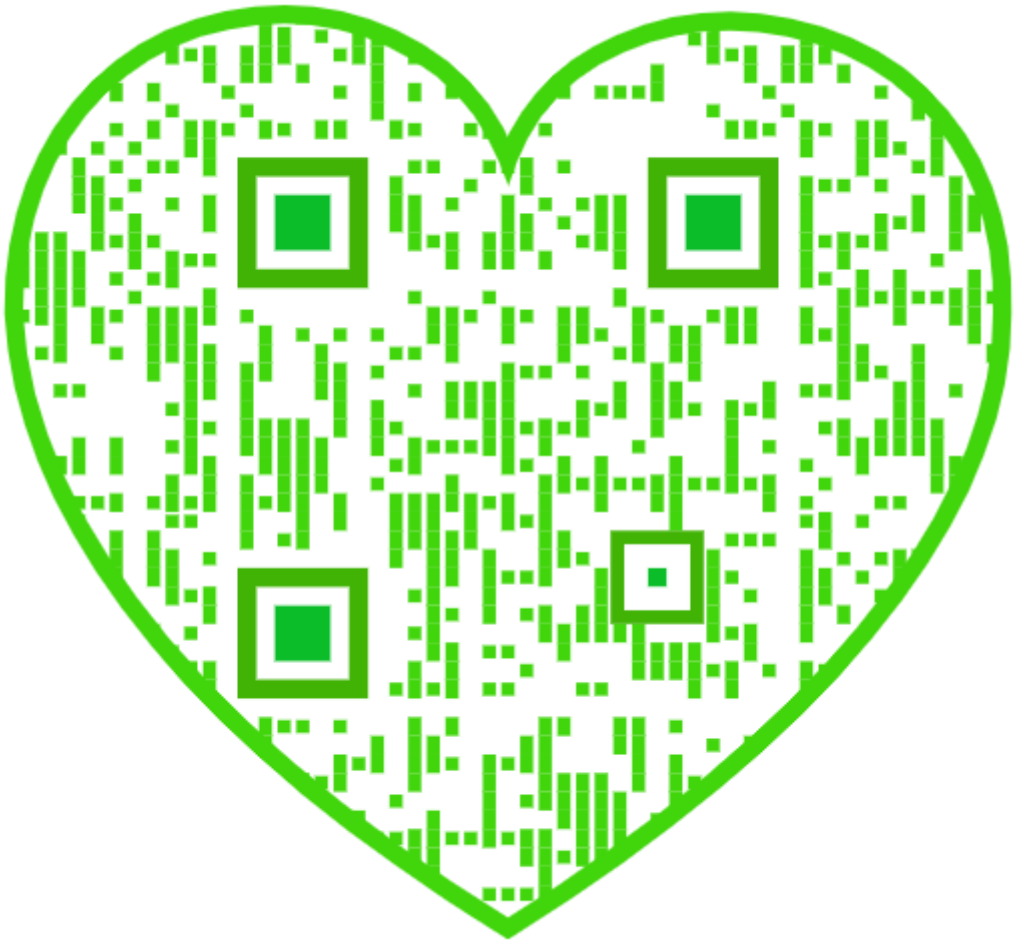


Retorts. Purifiers. Holder. Condensers. Scrubbers.

MANUFACTURE OF COAL GAS AT THE FOURTEENTH STREET STATION, NEW YORK.—[See page 214.]



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NEW YORK, SATURDAY, OCTOBER 6, 1900.

THE REPORT OF THE MERCHANTS' ASSOCIATION ON THE NEW YORK WATER SUPPLY.

The report of the committee of the Merchants' Association on the question of New York's water supply throws a flood of much-needed light upon one of the most, if not the most, important question affecting the welfare of this city. The highly creditable labors of the committee were prompted, as everybody knows, by a daring and reprehensible attempt by what is known as the Ramapo Water Company to obtain a monopoly of the available sources of water supply for New York; and the report before us achieves the double result of exposing the preposterous nature of the Ramapo scheme and presenting to the people of New York a clear view of the present status and future possibilities of this great question. It is almost superfluous to state that the high standing of the members of the committee, who are in every case prominent in the engineering, commercial and legal circles of the city, is such as to render the findings of the report absolutely reliable and authoritative.

In the first place, on the question of the necessity of at once taking steps to obtain a new source of water supply, the present report concurs with all reports that have preceded it, in pointing out the urgent need for taking immediate action in this direction. It is shown that unless some method of preventing the present waste of water is adopted, by 1903 the supply in Manhattan and the Bronx will be unequal to the demand; and although the use of water meters and other restrictive measures might render the present supply sufficient to meet the demands up to the year 1910, it is not considered likely that such restrictive measures would be acceptable, or even practicable. In looking for a new source of supply, the report throws out of the calculation altogether what is known as the Housatonic and Ten Mile River supply, chiefly because of the extensive legal complications which would be involved in a scheme contemplating the use of these waters.

The scheme recommended by the committee contemplates the construction of pumping stations and filter beds at Poughkeepsie, on the east side of the Hudson River, where the water would be led into a forebay, from which it would be lifted by high duty pumps to a settling basin of 25,000,000 gallons capacity, located about a mile and a half northeast of that city. From the settling basin the water would pass through 136 filter beds, each with an area of about three-quarters of an acre, and thence would be led into an aqueduct, 63 miles in length, and conveyed to a new covered reservoir of 250,000,000 gallons capacity, adjoining the new Jerome Park reservoir at New York. With a view to prevent the river above Poughkeepsie from becoming brackish from the tide because of the withdrawal of such large amounts of fresh water, it is proposed to construct compensating reservoirs in the Adirondacks, in which the flood waters would be held for delivery into the river during the dry season. An alternative scheme to this is the construction of a great aqueduct from Hadley in the Adirondacks, by which the waters of the North Hudson would be conveyed directly to New York city. It is estimated that 250,000,000 gallons daily of filtered water could be delivered from Poughkeepsie, at the city line at the level of the Jerome Park reservoir, at a cost of $28.33 per million gallons. The cost of an equal supply by aqueduct direct from the Adirondacks would be $30 per million gallons.

With regard to finance, it is encouraging to learn from the report that, during the sixty-seven years of its existence, the New York Waterworks Department has yielded a large revenue, the total net profits during that period having been over $21.000,000. The maximum cost of water per million gallons was $54.20 in 1849, and from 1866 to 1898 it was $35.06. At present the approximate cost of water at the city line is $29.07.

Having these figures in view, one can appreciate the astounding nature of the proposed contract with the Ramapo Water Company, by the terms of which the company is to build and maintain at its own expense works capable of delivering 200,000,000 gallons of water daily at the city line, under a head of 300 feet, and the city, commencing from 1902, is to pay $70 per million gallons for the water, the supply to be kept up for forty years. At the end of that time the works are to belong, not to the city, but to the company. As compared with the Ramapo proposition, it is to be noted that under the proposed scheme of the Merchants' Association Committee, by the year 1937 the city would be in possession of its own plant, free from all debt, whereas under the Ramapo system it would own nothing at all; for although between the years 1906 and 1917 the new system, under municipal ownership, would have an annual deficit, from 1917 on, the city would commence to realize an annually increasing profit, which would constantly increase until, in the year 1945 (the date of the termination of the proposed Ramapo contract), it would amount to $3,100,000 annually. The total excess of this profit over the deficit in forty years from 1906 to 1945 would be about $48,000,000. Again, the payment to the Ramapo Company of $70 per million gallons, after deducting the revenue from consumers of $50.29 per million gallons, would leave the city with a deficit of over $60,000,000, the total loss thus incurred reaching the sum of $108,000,000 in forty years of operation. In considering this loss, we must bear in mind that the city would possess no plant of its own.

The scheme outlined by the Merchants' Association Committee contemplates increasing the supply from the Hudson River by an additional supply of 250,000,000 gallons daily, to be added to, every fifteen or twenty years, as the growth of the population of the city may demand. The estimates, based upon the past very profitable operations of the New York Waterworks Department, make it certain that the supplying of water to the city, if it be carried out upon the lines suggested, will become increasingly profitable. No one can turn over the pages of the very able report which we have now before us, without concurring in the conclusion that immediate steps should be taken by the city of New York to acquire an additional supply of 250,000,000 gallons of water daily from the Adirondack watershed, by one of the two systems proposed.

GALVANIC ACTION OF COPPER SHEATHING.

The opponents of copper sheathing for our warships will find strong confirmation of their criticisms in the very ugly discovery that was made the other day on the British cruiser "Ariadne," and later on another cruiser, the "Spartiate." Copper sheathing was introduced to enable ships to remain at sea for longer periods than is possible when the steel plating of the hull is unprotected. The theory is good, and the practice of it would be equally so were it not for the disadvantage that the galvanic action of copper on other metals in the presence of salt water is liable to be very destructive. As long as the metal bolts which fasten the wood sheathing to the inner steel hull can be kept perfectly water-tight, and the salt water prevented from getting in contact with the steel hull, sheathing is no doubt an excellent device; but experience seems to prove that it is extremely difficult to preclude conditions favorable to galvanic action. In some cases the steel plating has been badly attacked, while in others, the fittings of the sea valves and other outboard connections have been seriously damaged. During the latter part of August, the "Ariadne," a new British cruiser of 11,000 tons displacement and 21 knots speed, was found to be leaking rapidly while at her moorings. The leak was of such dimensions that it was assumed that a Kingston valve had inadvertently been left open. After the vessel had been hurriedly docked, it was ascertained that the corrosion of the bolts, both inside and outside of the ship, had been so extensive that the mounting of one of the under-water fittings had fallen off, allowing a great inrush of water. The corrosion of the outer bolts of the "Spartiate," a sister ship, had previously been detected, and on docking the vessel it was found that the inner bolts had also been corroded. Referring to this most serious incident, The Naval and Military Record pertinently remarks: "One cannot fail to smile at the comic side of the question, since here we have ships copper-sheathed in order that they may keep the sea for lengthened periods, and yet because they are copper-sheathed, they cannot go through the peace maneuvers without becoming so leaky as to threaten their own safety."

We understand that signs of similar corrosion at the same point have appeared in our own sheathed cruiser "New Orleans;" and in view of these facts, we think that a most searching investigation of the whole subject should be made before we proceed with the proposed copper-sheathing of our own cruisers and battleships. Certainly the incident will greatly strengthen the position of the opponents of copper sheathing.

SPECTRUM OF RADIUM.

M. Demarçay has made another observation of the spectrum of radium, by which he finds that the chloride of radium has been prepared in an almost pure state; the sample was furnished by Madame Curie. The spectrum of its solution in hydrochloric acid has given three sets of rays: first, those of the platinum electrodes; second, a feeble spectrum of barium, reduced to its three principal rays; and third, the rays of radium, which have been already enumerated in a note presented to the Académie des Sciences some time since. The spectrum of radium is in this case very strongly marked, while that of barium has almost disappeared. No new lines have been found for radium, but the two nebular bands, which were somewhat faint in the previous spectrum, are now much stronger; the first of these commences somewhat sharply about 4621·9, with a maximum near 4627·5; it is nearly symmetrical with respect to this maximum, finishing near 4631·0. The second band is somewhat stronger; it begins sharply about 4463·7, with a maximum at 4455·2, becoming diffused toward the ultra-violet; it seems to end near 4390·0. As to the stronger rays of radium, they appear in this spectrum with great power and intensity, equaling the strongest ever observed, especially the rays 3814·7, 4340·8, and 4683·2. It is remarkable to observe that the spectrum of radium gives it as strong an analogy to the metals of the alkaline earths as is shown by the chemical reactions. The experiments were made entirely by the photographic method, as the quantity of material was too small to permit observation by the eye. It will be seen that the chloride of radium is now obtained in an almost pure state.

PALLADO-OXALATES.

In a communication recently made to the Académie des Sciences, M. H. Loiseleur describes the experiments by which he has formed a series of new compounds, the pallado-oxalic acid and its salts. M. Vezes had previously shown that oxalic acid transforms the pallado-nitrite of potassium, $Pd(NO_2)_4K_2$, to a salt which crystallizes in fine yellow needles, corresponding to the formula, $Pd(C_2O_4)_2K_2, 3H_2O$. To this salt he gave the name of pallado-oxalate of potassium. It is obtained more easily by the double decomposition of chloropalladite of potassium, $PdCl_4K_2$, and the neutral oxalate of the same metal. On account of the close analogy between the compounds of platinum and palladium, the experimenter supposed that the pallado-oxalate might be made the starting point for a series of compounds analogous to the plato-oxalates, which have been well studied by Söderbaum, and wished to obtain an acid corresponding to the plato-oxalic acid, $Pt(C_2O_4)_2H_2+Aq$, described by the latter. He has been successful in producing this acid and a number of its salts, and describes the method employed. If a hot concentrated solution of pallado-oxalate of potassium is poured into a hot solution of nitrate of silver, the formation of a yellow precipitate is observed. The liquid, after filtering, deposits upon cooling golden-yellow needles which act upon polarized light. The precipitate is redissolved in boiling water, and this solution also deposits yellow crystals of the same form. Analysis of the crystals gives the formula of a pallado-oxalate of silver, hydrated: $Pd(C_2O_4)_2Aq_2, 3H_2O$. This salt is but slightly soluble in water, taking 180 times its volume of boiling water to dissolve it; the solution is not very stable, and in time decomposes with a black deposit of palladium at the surface and on the walls of the vessel. The dry salt is also decomposed by the action of light, and must be preserved in the dark. In the second expriment, a solution of the latter salt is treated by an exact equivalent of hydrochloric acid; a precipitate of silver chloride is formed, and when this is separated, a yellow-brown liquid is obtained. This liquid is unstable, but with some precautions it may be evaporated in an oven and thus concentrated; upon cooling, it deposits crystals of the pallado-oxalic acid, which take the form of needles more or less fine as the cooling has been done rapidly or slowly; these crystals are of a yellow or yellow-brown color, and act strongly on polarized light; they are quite soluble in water and the solution is strongly acid. Analysis gives the formula, $Pd(C_2O_4)_2H_2, 6H_2O$. With the acid thus obtained, a number of salts have been formed. The sodium salt crystallizes in yellow needles, which are larger than those of the potassium salt. They are very efflorescent in air and lose their luster, becoming a yellowish white. The barium salt is formed by adding bromide of barium to a cold solution of the acid. It is an orange-white powder, but slightly soluble in water; boiling water dissolves only 1–2000 part. By cooling the yellow-green liquid thus formed, small yellow crystals are deposited, which act upon polarized light; the bromide has the formula, $Pd(C_2O_4)_2Ba, 3H_2O$. In these experiments, four new bodies have been obtained, the pallado-oxalic acid and three of its salts, those of silver, barium and sodium. It should be remarked that this is the only complex acid of palladium which has been obtained up to the present. Since the researches of Roessler in 1886, who tried unsuccessfully to produce the pallado-cyanhydric acid, palladium was considered as incapable of forming complex acids, thus showing but little of the metalloid character exhibited by platinum in most of its compounds. The experiments show that this is not the case, and the metalloid character is even more strongly shown in the case of palladium, as will be remarked from the fact that the crystals of pallado-oxalic acid are very well defined, but those of the plato-oxalic acid have been obtained by Söderbaum only in masses of confused crystals.

THE MASTERY OF THE OCEAN.

The close of the nineteenth century witnesses the well-nigh complete triumph of human invention over the obstacles to speedy intercommunication presented by the vast expanse and multiplied dangers of ocean travel. It is a far cry from the little 350-ton steamer "Savannah" of the year 1819 to the 23,000-ton "Deutschland" or the 28,000-ton "Oceanic" of the present day, but the difference between the 28-day trip of the first steam vessel to cross the Atlantic and the recent 5½-day trip of the "Deutschland" shows that the marine architect and engineer have employed the intervening years to good purpose. Not merely have they found a way to carry a complement of 2000 souls across the Atlantic at something like railway speed under normal conditions of weather, but they have so greatly increased length and beam and depth, and have multiplied boiler and engine power so liberally, that the biggest of our big liners can go smashing its way triumphantly through an Atlantic gale, opposing the momentum of giant seas with the momentum born of 23,000 tons of displacement backed by 37,000 horse power in the engine room.

The following notes were made by a representative of this journal, who had the good fortune to be on the "Deutschland" when she made her recent record-breaking passage. The outward voyage was noteworthy for the high average speed maintained, 23 36 knots an hour, the high average horse power developed, 36,913 for the whole voyage, and for the fact that the passage was the shortest ever made between any points in America and Europe, the time from Sandy Hook to the Lizard being 5 days 7 hours and 38 minutes. The return journey, in view of the highly unfavorable weather conditions, was even more remarkable; for, although head winds, varying in strength from 7 to 11 out of a possible strength of 12, with exceptionally high seas, were encountered on the first four days of the trip, the run from Cherbourg to Sandy Hook was accomplished in 6 days and 33 minutes at an average speed of 21·16 knots an hour.

The eastward record was rendered spectacular in the public eye by the fact (purely accidental, as it happened) that the "Deutschland" was scheduled to sail one hour later than the "Kaiser Wilhelm," whose fastest record of 22·79 knots an hour had been accomplished on her last eastward run. Twenty-two and a half hours after starting, the "Deutschland" was abreast of the "Kaiser," and she continued to add to her advantage at a remarkably even rate of one knot per hour. At the invitation of Mr. A. Bliedung, the chief engineer, our representative visited the engine and boiler rooms while the two vessels were abreast in the so-called race, and at a time when the "Deutschland's" engines were indicating between 37,000 and 38,000 horse power, and he was at once impressed with the quiet and orderliness with which the staff of engineers, firemen and coal-passers were doing their work. The temperature in the stokeholds and on the lower engine-room platforms was but slightly above the normal of the atmosphere, and this in spite of the fact that coal was being consumed in the 112 furnaces at the rate of 572 tons per day, and that steam at 213 pounds pressure was being expanded in the twelve cylinders of the twin, quadruple-expansion engines at the rate of 178 tons per hour. No clearer proof of the fact that steamship designing, as carried out in a first-class establishment, is an exact science, and shipbuilding a perfected art, could be asked for than was presented by the utter absence of excitement or evidence of unwonted effort in the engine and fire rooms of this fine vessel under circumstances where such excitement would have been expected and natural. That a 23,000-ton "Deutschland" with 37,000 horse power would overtake and pass a 20,000-ton smaller edition of herself with 28,000 horse power was a foregone conclusion, provided, at least, that the safety valves were just lifting at the Board of Inspection pressure of 213 pounds to the square inch.

Steam is led to two 36⅝-inch high-pressure cylinders which are placed in tandem above two 108¼-inch low-pressure cylinders, the total height from the lower platform to the top of the high-pressure cylinders being 45 feet. It then passes to a 73⅝-inch first intermediate, then to a 104-inch second intermediate, and finally to two 108¼-inch low-pressure cylinders, from which it is led to a surface condenser with 21,315 square feet of cooling surface. There is thus quadruple expansion in six cylinders, acting on four cranks, the two intermediates being above the two outside cranks, and the four high and low-pressure cylinders driving the two inside cranks. All the reciprocating and rotating parts are of massive proportions. Thus, each low-pressure piston weighs 7 tons, the piston rod 3 tons, and the connecting rod 10 tons. The crank shaft is 59 feet 3⅜ inches long, of 3 feet throw, and weighs just under 100 tons. When it is remembered that each of these mammoth engines runs at the exceptionally high speed of 77 to 80 revolutions, and that the piston speed runs up as high as 1,040 feet per minute, it can be understood that a view of the two engines from the amidships bulkhead doorway, when the ship is at full speed is profoundly impressive. The cut-off for the high-pressure cylinders is at 73 per cent, for the two intermediates at 70 per cent, and for the two low-pressure cylinders at 62 per cent. Bearing in mind the high initial pressure, the late cut-off, the length of the stroke and the high piston-speed, one can realize how the unprecedented indication of 36,913 horse power for the whole voyage could be accomplished.

The total coal consumption for twenty-four hours, including the auxiliaries, was 572 tons, which works out at the highly economical figure of 1·45 pounds per horse power per hour. This high economy is due in general to the all-round excellence of the boilers and engines, but particularly to the Howden's forced draught, with which the boilers are fitted, in which the air supply to the furnaces is raised by the heat of the escaping furnace gases from 70° to 270° Fah. before it enters the furnaces, the temperature of the uptake being lowered by a corresponding 200° Fah.

On the return trip to America the "Deutschland" received the first real test of her capabilities in varying conditions of wind and sea, and the result proved that, given a vessel of sufficient strength, weight and power, the full strength of an Atlantic gale is powerless to stop her. Leaving Cherbourg at 6:40 P. M. on the 17th ult., she at once encountered a fresh wind and rough beam sea, in which an average of 22·1 knots was maintained for 17 hours, or until noon of the 18th. In the next 24 hours the vessel made 440 knots in squally weather and a very rough sea, despite a lengthy detention while steaming in a circle and lowering a boat in search of a seaman who had been carried overboard. On the 19th the wind increased to a strong gale, the rollers meeting the ship on the port bow. For six hours it blew with a strength of 10 to 11 out of a maximum possible rating of 12, and the ship maintained a trifle over 20 knots against what the ship's log designates as a "strong gale, with long, heavy rolling sea, and irregular high swell," the crests of the rollers making a clear sweep of the forecastle deck and falling in a magnificent cascade far to leeward. It was only after the seas had torn loose an iron ladder and twisted the railing of the forecastle deck that the engines were slowed down to 13·5 knots, at which speed for four hours the ship rode easily across the seas without the least suggestion of a roll. The utter absence of rolling in a quartering sea of such proportions was surprising, for in the height of a gale in which the "St. Paul" had to turn and run before the seas for five hours, it was not necessary to place the racks upon the table at the lunch hour. On this day the ship ran 502 knots, an average of over 20 knots an hour. On the following day the vessel made 573 knots, and on the last day over 600 knots, although, owing to an error of calculation, the run was given as only 581 knots.

It is inevitable that the development of 37,000 horse power on the propellers of such an elastic structure as the hull of a 700-foot liner should result in a certain measure of vibration. This vibration is not due to defective balancing in the engines, which are built on the Yarrow-Schlick-Tweedy system, but is probably inevitable when two propellers are each expending 18,000 horse power upon the water. We very much question whether the application of turbine propulsion will remove a difficulty whose source evidently lies elsewhere than in the engine room.

EXPERIMENTS ON AMALGAMS.

Messrs. Guntz and Férée have recently made a communication to the Académie des Sciences describing a series of experiments which they have made with amalgams of different metals, particularly those of sodium and potassium; they have succeeded in obtaining a series of amalgams of these metals having a crystalline form and a definite composition. The first experiments were made with sodium; when it is dissolved in mercury, the latter becomes heated, and by slow cooling fine crystals of the amalgam are formed; these have a cubical appearance, and their composition as shown by analysis corresponds to the formula $NaHg_8$. Another method of obtaining the crystals is to dissolve the sodium in the mercury as before, and then compress the whole in a chamois skin; the more liquid part filters through, and the remainder is found to have the same composition as before. The liquid part consists of mercury saturated with sodium and contains, according to analysis, 0·57 per 100 of the latter. The experimenters conclude that the amalgam $NaHg_8$ should be considered as a definite compound. In an experiment made by Kerp, in which he saturated the mercury with sodium by an electrolytic method, the mercury became heated to increasing temperatures and amalgams were obtained which contained more sodium than the formula demands; to explain this result he thought that an amalgam $NaHg_8$ existed, but could not obtain it in a pure state; it condensed mercury in its pores in variable proportions.

The present experimenters consider that it is the result of a mixture of two amalgams, $NaHg_8$ and $NaHg_5$, and in fact have obtained the latter in a pure state by the following process. The crystals of $NaHg_8$, obtained as above, are melted in a porcelain capsule; to this is added a small quantity of amalgam richer in sodium, containing 3·5 per 100. When the whole is dissolved at 200° C. it is slowly cooled and the temperature observed by a thermometer; when 140° is reached, the temperature remains stationary for some time, with formation of crystals of amalgam. At 138° the liquid part is poured off, and prismatic crystals are found to remain; these give by analysis the formula $NaHg_5$. The liquid portion solidifies entirely by cooling to 96° C., and is found to be $NaHg_6$. The solution of sodium in mercury is thus separated into two amalgams of definite composition. The experimenters have formed two other amalgams; by submitting one or the other of the above compounds to strong compression, from 3,000 to 12,000 pounds per square inch, they are found to lose mercury with the formation of a new amalgam, $NaHg_4$. The mercury which escapes is always saturated with sodium at 0·57 per 100; when this solution is cooled to a low temperature, 19° below 0° C. it forms crystals of another amalgam, $NaHg_8$. This new compound, separated from the excess of mercury, melts partially when it reaches the ordinary temperature, giving crystals of $NaHg_6$ and mercury saturated with sodium. It is thus demonstrated that sodium forms with mercury four definite compounds of crystalline form, corresponding to formulæ $NaHg_8$, $NaHg_6$, $NaHg_5$, $NaHg_4$. With potassium similar results have been obtained. By slowly cooling the solution in mercury, crystals of KHg_{12} are formed. These, when compressed, lose a portion of fluid amalgam, and the remainder has the formula KHg_{10}. By cooling the liquid portion to —19° C., crystals of KHg_{18} are formed.

OPERATION OF WELSBACH BURNERS.

A new system of operating Welsbach burners from the gas works has been established at Emmerich on the Rhine; by this arrangement the burners are automatically lighted and extinguished by the use of compressed air; and about two hundred burners are thus operated in eighteen seconds. The apparatus used, known as the Lenze system, consists of a kind of cylindrical box placed in each lamp; the box is divided into two chambers which are separated by mercury. One of these chambers serves as a reservoir for compressed air, and the other for gas. Into the inner chamber a gas pipe penetrates, which is united by a float to a valve closing the passage of the gas, or on the other hand giving it access to a burner placed on the cover of the apparatus. A small auxiliary flame remains always lighted, according to the method generally employed. When compressed air is sent into the apparatus from the central station, it first opens the passage of gas to the burner and afterward lights it. The system works with a rather low air pressure. The installation costs $12.50 per burner in most cases; the expense of lighting by hand is gained, and it is found that the burners last longer, owing to regularity of their illumination.

A CACTUS IN THE BOTANICAL GARDEN AT BERLIN.

In the botanical garden of Berlin is to be seen a cactus which has grown for seven years in a glass flask sealed by fusion; it was presented by a German pharmacist, Ludwig Rust. He explains the growth of the plant by the fact that the soil in which it grows contains a certain quantity of spores of fungi, which germinate from time to time and cover the sides of the flask with a greenish layer. These, in dying, furnish the carbonic acid necessary for the life of the cactus. This explanation appeared satisfactory at first, but it was then asked from whence came the carbonic acid for the fungi; again, the phenomena of nutrition which take place in the green parts of the plant require an excess of carbonic acid. This seems, in fact, to be furnished by the process of putrefaction which takes place in the soil. Another question which is more difficult to answer is the origin of the water which is necessary to maintain the life of the plant; this may be derived from the decomposition of the cellulose. However these questions may be answered, the fact remains that the plant lives and develops in a hermetically closed medium. The experiment is not difficult to carry out, and its study may lead to interesting results.

PARIS EXPOSITION AWARDS.

The Jury of Final Appeal in the Exposition awards has finished its work. The statement prepared for the United States Commission shows that America received a higher total of awards than any other nation save France, and that she also received more awards in each classification, except grand prizes, in which Germany secured a greater number. The figures, excepting for France, follow:

Grand Prizes—United States, 215; Germany, 236; Russia, 209; Great Britain, 183.

Gold Medals—United States, 547; Germany, 510; Russia, 346; Great Britain, 406.

Silver Medals—United States, 593; Germany, 575; Russia, 411; Great Britain, 517.

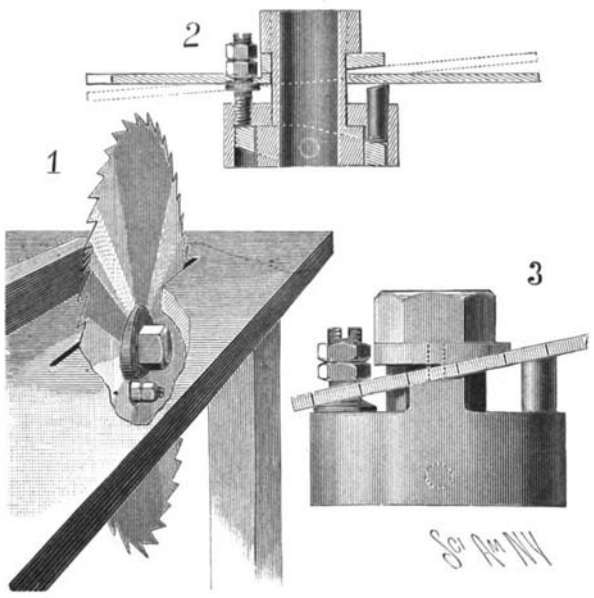
Bronze Medals—United States, 501; Germany, 321; Russia, 321; Great Britain, 410.

Honorable Mention—United States, 348; Germany, 184; Russia, 206; Great Britain, 208.

A NOVEL GROOVING-SAW AND DADO-HEAD.

In a very ingenious invention which has been patented by James M. Garrison, of Santa Barbara, Cal., a simple mechanical device has been provided for quickly setting a grooving-saw in any angular position relatively to the arbor, to cut wide or narrow grooves. Fig. 1 is a perspective view of the invention. Fig. 2 is a sectional plan view. Fig. 3 is a plan view with the saw-blade set at an angle.

The body of the dado-head carries lugs which engage one face of the saw-blade. The other face of the blade



AN INGENIOUS ARRANGEMENT FOR ADJUSTING WABBLE-SAWS.

is engaged by a washer beveled at one side to fit the blade when tilted. Adjusting devices hold the saw-blade at any angle relatively to the saw-arbor. These adjusting devices comprise an adjusting-screw received in the head and a pin sliding in the head. A ring-shaped lever is fulcrumed in the head and is engaged at opposite sides by the screw and pin. The adjusting screws, as shown in Figs. 2 and 3, has a collar on one side of the blade and two nuts on the other.

In tilting the blade from one position to another the adjusting-screw is turned by means of a screw-driver, thereby raising or depressing the oppositely-located slidable-pin, so that the blade is set at the desired angle. The mere turning of the screw causes a proper tilting of the saw. The ease and rapidity of this adjustment are meritorious features not found in similar devices which have been hitherto employed. The arrangement is adaptable to saw-arbors, shaper-arbors, or to any arbor on which a dado-head can be fitted. The only tool employed in adjusting the blade is a screw-driver.

Improvement in Celestial Photography.

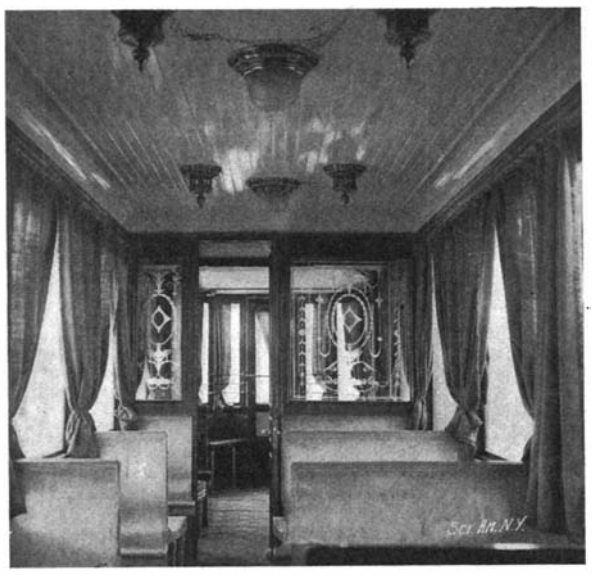
Where anything like systematic astro-photography is contemplated, it is customary to rely upon one of two expedients. Sometimes a telescope is built exclusively for this line of work. The objective is corrected so that the actinic violet rays concentrate at just the right point. But such an instrument is worthless for visual work, and it is employed only for photography. This is the case, for instance, with the fine 24-inch glass given to Harvard by the late Miss Caroline W. Bruce. The other resource is to provide an additional correcting lens that can be swung into position in front of the object glass. This is the plan adopted at the Lick and Greenwich observatories. It works admirably, but it has drawbacks. The corrector is heavy and costly. It absorbs a good deal of light and reduces the photographic power of the instrument accordingly; and the focus is shortened, so that the plateholder must be thrust up inside this tube a little distance from the eye end. A new way of meeting this difficulty is reported from the Yerkes Observatory, which, though conducted under the auspices of the University of Chicago, is situated at Williams Bay, Wis. In the September number of The Astro-Physical Journal, Prof. George E. Hale, the director, recounts some recent experiments by G. W. Ritchey, of his staff. The great 40-inch telescope at this observatory was designed for visual work and has no correcting lens. But such an attachment is now found to be unnecessary. If a thin yellow screen is placed in the focal plane of the instrument and a photographic plate in immediate contact therewith, the most gratifying results are secured. The pictures show a sharp definition never before exhibited in work done with visual telescopes. Special screens have been made under Mr. Ritchey's supervision. They are of plate glass, coated with collodion, and having a delicate, greenish yellow tint. Prof. Hale says that Mr. Ritchey suggested this expedient eight years ago, and tried it on the moon—a very bright object—in 1897. But so far as is known, no attempt to photograph faint objects like nebulæ and star clusters has been made until now. A fine picture of the famous globular cluster in the constellation of Hercules, containing several thousand stars—at least 3,200 have been counted on the plate—has been secured by Mr. Ritchey after an exposure of ninety minutes. A comparison of this photograph with those obtained with special photographic telescopes demonstrates the success of the method. The achievement opens the way to several other lines of photographic research, notably parallax work, in addition to "spectro-heliography," which is Prof. Hale's specialty. And the example thus set by the Yerkes Observatory will doubtless be followed elsewhere.—New York Tribune.

THE LANGEN MONO-RAIL ROAD AT THE PARIS EXPOSITION.

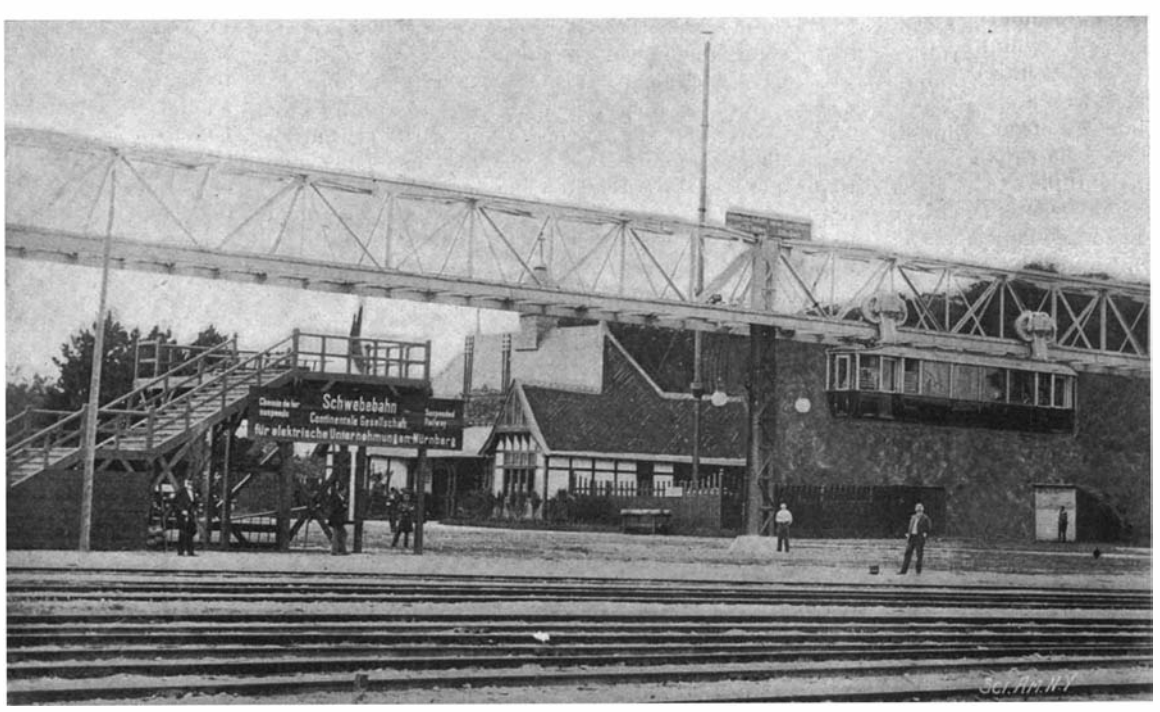
In our issue of May 5, 1900, we published an exhaustive illustrated description of the Langen suspended railway, which, as an engineering novelty, has attracted no little attention here as well as abroad. The Continentale Gesellschaft fuer Elektrische Unternehmungen, the builders of the suspended railway extending from Barmen to Elberfeld in the Wupper Valley, Germany, have installed at the Vincennes Annex of the Paris Exposition a short road operated on the Langen system. The Vincennes road is about 200 feet in length and is composed of two bridges, each of 100 feet, resting upon three central posts. The cars run on each side of the posts on two double-wheeled motor-trucks attached to the car roof. Current is fed by a slip shoe and a contact-rail.

The general appearance of the cars is shown in our illustrations. Each car has a capacity of fifty and is divided into first-class, second-class, and smoking compartments. The motors are of 36 horse power, and the speed (on the Barmen-Elberfeld road) about 25 miles an hour. Westinghouse air-brakes, as well as electrical and hand brakes, are provided.

The Vincennes road, although in working order, has not been continuously operated, since its short length hardly enabled the exhibitors fully to demonstrate the merits of the system.



INTERIOR OF CAR.

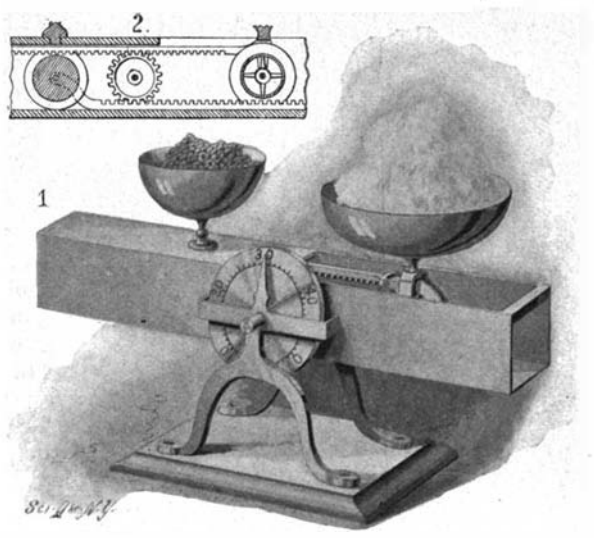


LANGEN SUSPENDED RAILWAY EXHIBITED AT VINCENNES.

A COTTON PER CENT SCALE.

A scale of simple construction to be used for determining the percentage of lint contained in seed-cotton forms the subject of an invention for which a patent has been taken out by George R. Brown, Pledger, Tex.

The scale comprises a balance-beam mounted on a



A COTTON PER CENT SCALE.

rock-shaft and provided with two trays—the one fixed, the other movable. The movable tray is supported by arms in which a flanged roller is journaled. Extending from the arms lengthwise of the beam is a rack which passes over a second flanged roller serving as a counterpoise. From the spindles of the second roller another rack extends along the bottom of the beam and underneath the first roller. The two racks mesh with a pinion carried by the rock-shaft. A hand-wheel is also mounted on the shaft, and on the surface of the hand-wheel numbers are inscribed with which a pointer coacts to indicate the percentage of the material in the trays. By rotating the hand-wheel the counterpoise roller and the movable tray are caused to move toward or from each other. As the proportion of lint to seed-cotton varies from 25 to 40 per cent, the scale is graduated only from 25 to 50 per cent.

A handful of cotton is taken from the lot offered for sale and cleaned with a small hand-gin. The seeds, with the hulls and dirt, are placed in the fixed tray; and the lint is deposited in the movable tray. The hand-wheel is then turned until the beam is balanced. By referring to the scale, the percentage of lint contained in the cotton is immediately ascertained.

Islands of Chincha.

In the South Sea, opposite the Bay of Pitco, and nearly midway between the equator and the tropic of Capricorn, are found the Chincha Islands. These are, in reality, only a series of bare, rocky peaks, which rise out of the ocean. Although their surface is but small, it is no less true that not long ago this was one of the richest territories in the world on account of the extensive guano beds which were to be found here. These had been formed by the innumerable sea-birds which inhabited the rocks. To judge of their number and the length of time elapsed, these islands have furnished seven million tons of guano, whose value may be estimated at one billion dollars. The deposit reached a great depth, being usually more than 90 feet thick, and in some places it even reached 180 feet. In order to load it upon the boats, a quay was constructed in one part of the island. Since 1870, however, all the guano has been removed, and the island has become deserted. One thing of interest remains, namely, the seals, which are very abundant here. According to M. Lucas, who has lately visited the islands, the Otaria jubata is found in large numbers. There are many caverns which open directly into the water, and it is in these that the seals congregate to take their repose. It is difficult to capture them, however, on account of the shape of the islands.

THE USE OF FLEXIBLE BRIDLES ON KITES.

How great is the effect of wind pressure on a kite sailing in a stiff breeze every boy knows who has ever felt the strong and steady tug on a flying line. But wind pressure, besides exerting a great strain upon the line, also prevents the kite from attaining a position directly overhead. In meteorological work, it has therefore been necessary, as a general rule, to use lines of great length in order that the kites, with their freight of recording instruments, could reach the height desired. At most of the observatories, however, a device is used to lessen the strain on the lines and to permit the kite to assume a position more nearly at right angles to the horizontal, a device so simple, in fact, that any boy can make and apply it to his own kite.

In the lower part of the bridle of the kite, as indicated in Fig. 1, a strong elastic band is inserted, provided with a retarding string to prevent the expansion of the band beyond the breaking point. The effect of this rubber band is twofold. In the first place, as illustrated in Fig. 2, in which the full lines represent an ordinary kite and the dotted lines the kite under discussion, the kite starts on its upward course from a nearly vertical position. As it rises and the wind pressure increases, the kite inclines more to the horizontal and the elastic band expands (shown in the second position of Fig. 2). The stretching of the band absorbs much of the strain, which would otherwise be transmitted through the flying line, and diminishes the angle of incidence of the resisting surface to such a degree that the kite can reach the horizontal position shown in Fig. 2. The wind pressure on the resisting surface being at that point reduced to a minimum, the elastic band is relaxed and the kite assumes the fourth position represented in Fig. 2.

At the Blue Hill Observatory, kites provided with yielding bridles of the type described have been flown in gales of fifty and sixty miles an hour without breaking loose—a feat which probably could not be performed with ordinary bridles.

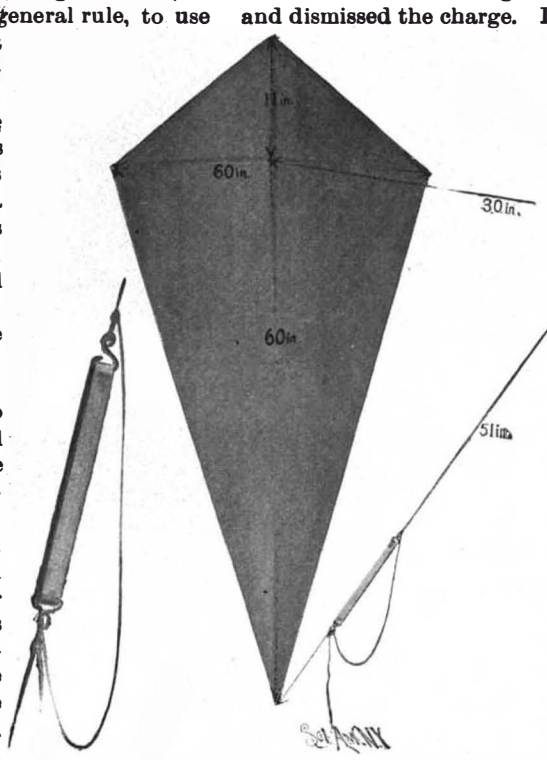


Fig. 1.—A MALAY KITE PROVIDED WITH AN EXPANSIVE BRIDLE.

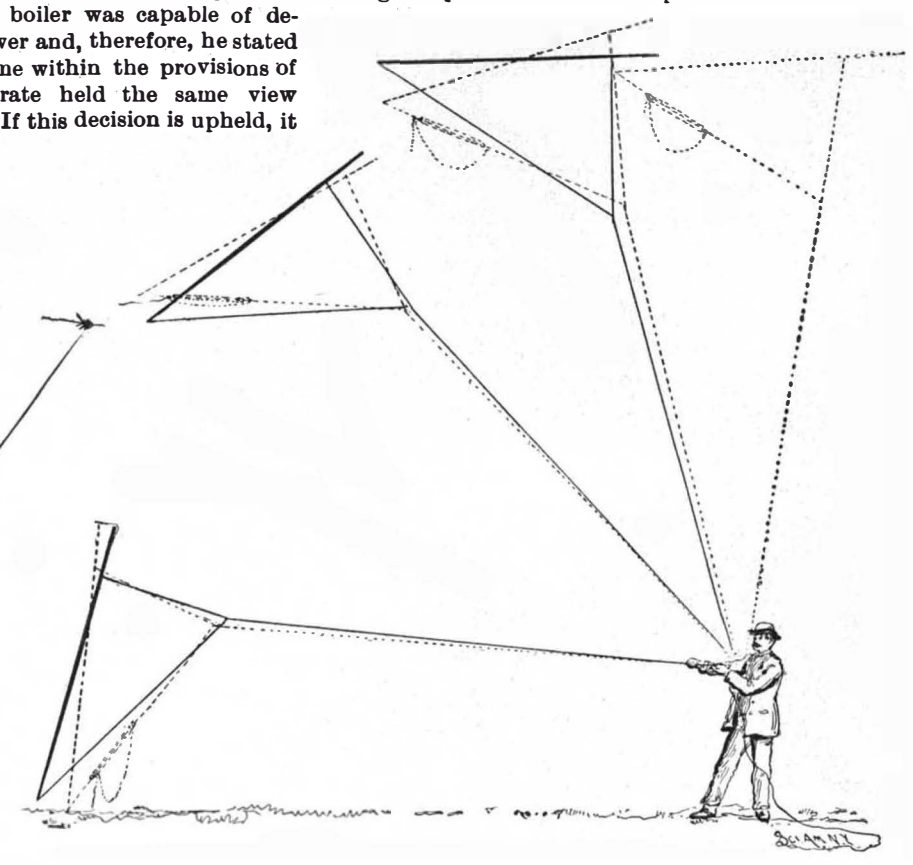
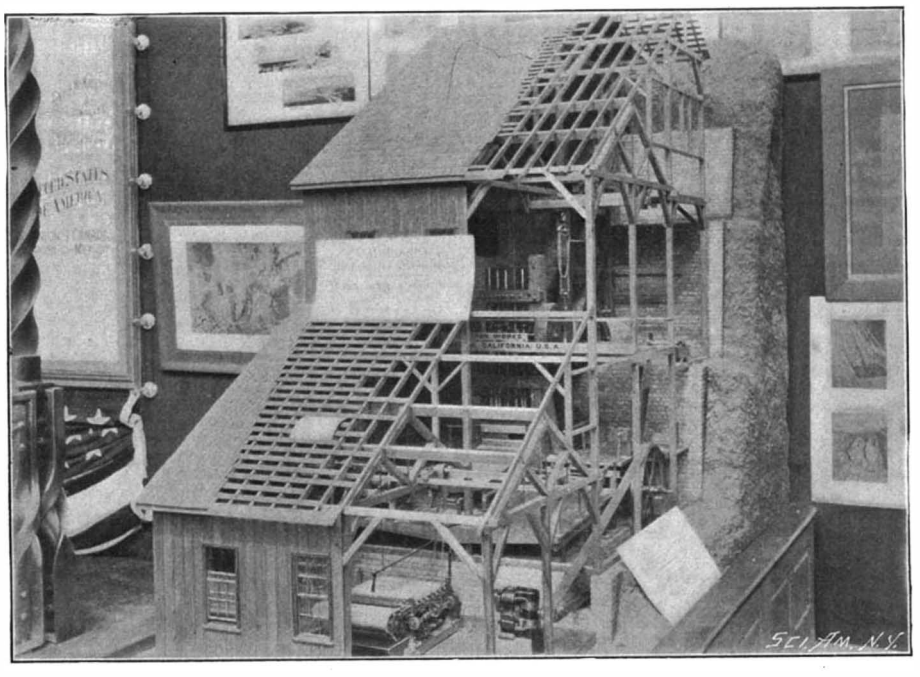


Fig. 2.—THE ASCENT OF THE NEW AND OLD KITES.

SOME METALLURGICAL EXHIBITS AT THE PARIS EXPOSITION.

Among the notable exhibits at the Paris Exposition are those of Messrs. Tiffany & Co., the American jewelers. Their collection is intended to be educational, showing the precious and semi-precious stones of the United States. It has been purchased, and presented to the American Museum of Natural History. In front is a large section of rhodonite, besides large quartz crystals and arrowheads, fine sections of agate, amethyst, etc. The sphere seen at the top is cut from rock crystal. At the sides are specimens of malachite, rough and cut, from the Arizona mines. An interesting piece is a section of meteorite containing peridot; cut and uncut gems of all kinds are shown, including beryl, sapphire, tourmaline, etc. A smaller case contains specimens of petrified wood from Arizona, with sections of trees; also collections of precious stones. One of our illustrations shows a fine model of a California gold stamping mill, to be seen in this section; it is about seven feet high, including base. It has been built under the direction of the California Commission by the Union Iron Works, of San Francisco. The machinery is driven by a small electric motor, illustrating the different processes by which the ore passes to the crusher, stamping mills, concentrator, etc.



CALIFORNIA GOLD-STAMPING MILL AT THE PARIS EXPOSITION.

THE EXHIBIT OF MESSRS TIFFANY & COMPANY, PARIS EXPOSITION.

Automobile License.

An interesting decision was recently rendered in a New York police court by Magistrate Olmsted. A locomobile driver was arrested on Fifth Avenue, and he admitted that he did not have an engineer's license. He was charged with violating a section of the charter which says that only licensed engineers shall use or take charge of steam boilers carrying over 10 pounds of steam or of more than 10 horse power. At the time of the arrest the pressure in the boiler was 220 pounds. The driver proved that the boiler was capable of developing only 6½ horse power and, therefore, he stated that the vehicle did not come within the provisions of the charter. The magistrate held the same view and dismissed the charge. If this decision is upheld, it of course means that no licenses will be needed for steam carriages which have a capacity of less than 10 horse power, but the charter seems explicit in referring to both pressure and power.

A New Incandescent Lamp.

At the Paris Exposition is to be seen a new process of incandescent lamp manufacture, in which the vacuum is obtained in the bulb by the absorption of the gases by certain chemical substances, which have been previously introduced into it; this is known as the Malignani process. At the Exposition an installation has been made for manufacturing the lamps, and the visitor may follow the operations. A partial vacuum is first obtained in the bulbs by an air pump; to absorb the remaining gases red phosphorus is the compound generally used; it is formed into a somewhat liquid paste, which is introduced by means of a piece of cotton on the end of a wire into the tube by which the bulb is exhausted, and the walls of the tube are coated with the paste. A vacuum of a millimeter is first made by the air pump. It is found that at this low pressure many of the gases will be absorbed by the compound used, especially oxygen, hydrogen, nitrogen and the hydrocarbon gases; the latter are most easily absorbed, and are in consequence used in practice. After the partial vacuum has been reached, the hydrocarbon gases are introduced into the bulb to displace the air; the pump is operated for half a minute while a current is sent into the filament which brings it to low redness. When the vacuum is made as nearly complete as possible by the air pump, a stronger current is passed in the filament, and the outside of the bulb is heated by a small gas furnace placed below it and by directing a gas flame upon the tubular part of a rubber tube to remove all moisture. When the vacuum has reached a certain point, a light blue discharge appears at the positive pole, which increases, and eventually fills nearly the whole of the bulb; at this point the lamp is separated from the pump by melting off and closing the tube. The chemical product on the walls of the tube is then heated, and it absorbs the remaining portion of the gases; at this point the discharge appears to fill the whole of the lamp, having a light blue appearance. Upon heating the lamp for a few moments the discharge disappears, and the vacuum is complete. The glass tube is then removed from the bulb by melting off in a blowpipe flame. The advantages claimed for this lamp are that the vacuum is better, the operation is more rapid, and it does away with the inconvenience of using mercury pumps.

OF the 46,988 deaths which occurred in Paris for the year 1899, says Technische Notizen, no less than 12,314, hence about one-fourth, were due to consumption; 37·2 per cent of these persons died between the ages of 1 and 20, 60·2 per cent between those of 20 and 40. Hence two-thirds of all victims of this disease were claimed by death in the prime of their life.

MANUFACTURE OF ILLUMINATING GAS.

I. COAL GAS.

In the present illustrated description of the modern method of manufacturing coal gas, we have chosen the large station at the foot of Fourteenth Street, near the East River, in this city, as being thoroughly representative of the present state of the art, as carried out on a large scale. By the courtesy of Dr. Elliott, the chief chemist of the Consolidated Gas Company, our artist was enabled to make the accompanying drawings, in which the salient features of this vast plant are grouped together in such a way as to enable the reader to follow the process from the charging of the retorts to the final delivery to the city mains.

The station which is herewith illustrated is one of ten which are owned by this company, in three of which coal gas is manufactured, while the others are devoted to the manufacture of water gas. The Fourteenth Street station covers an area of several city blocks, and in the course of each year, 125,000 tons of bituminous coal are consumed in producing gas at the rate of from 3,000,000 cubic feet per day in the summer to 5,000,000 cubic feet per day in the winter season. The plant is in constant operation for the whole twenty-four hours, and although the exigencies of manufacture require that certain parts of it be briefly closed for repairs, there is no time in the year, or from year to year, in which the whole establishment is idle.

Illuminating gas is obtained from coal by the operation which is chemically known as destructive distillation, and technically as carbonization. The carbonization is accomplished by placing the coal in closed air-tight retorts which are raised to the proper temperature for driving off the various gases and converting the coal into coke. The retorts employed at the works under consideration are of the D shaped pattern, and are manufactured of fire clay, which, on account of its refractory nature and its cheapness and durability, has been proved to be the best material for this purpose. The retorts are 25 inches in width, 14 inches in height, and 9 feet in length, and they are arranged in three tiers, as shown in the sectional view at the bottom of our first-page engraving. They are grouped in series of six. Each six constitutes a "bench," and each bench is supported within an arched setting, while below is provided a deep and somewhat narrow furnace, the air for the supply of which passes up from below through the fire bars. The heating furnace is charged with a portion of the coke which forms the solid residuum in the retorts. For purposes of economy, the furnaces are fired on the regenerative principle, only sufficient air being supplied through the fire bars for the production of carbon dioxide gas, which, passing up through the upper stratum of coke, serves to maintain it at a steady glow of heat, the final carbon monoxide gas being ignited and burnt beneath the lowest tier of the retorts by means of heated air, which is led in through special air ducts provided for the purpose. These ducts will be noticed in our sectional view of the retorts.

The view referred to shows one side of what is known as a "range" of retorts. In this particular range we see the front face of twelve benches which contain in all seventy-two retorts. On the opposite side, or what is technically known as the back of the range, are twelve other benches, thus making a total of 144 in all. There are in the Fourteenth Street station six of these ranges, and the total number of retorts will thus be seen to amount to 864. Each retort of the particular type shown can make 10,000 cubic feet of gas in every twenty-four hours.

Although the principles of coal gas manufacture are the same to-day as they were in the early days of the art, there has been a vast advance in the details of the plant, the development of special appliances and tools, and the general systemization of the work. Our illustrations show two of the most remarkable machines of recent design, known as the "charger" and "discharger," the latter being shown in some detail at the nearer end of the range, while the former is seen further down the line. Each machine travels on a track which completely surrounds the range of retorts. It carries its own steam boiler and engines for moving the machine down the front of the retorts and performing the various operations of charging and discharging. At the top of the discharging machine is a hopper capable of carrying six tons of coal, or sufficient to charge the whole line of retorts on one side. Below the hopper and placed vertically below one another, are three automatic scoops which are arranged at heights corresponding to the level of the three tiers of retorts. The scoops are rectangular in section and of such length and capacity as to contain the proper amount of coal for charging the retorts. They are loaded by gravity from the hopper and are thrust simultaneously into the retorts, where, by means of a very ingeniously contrived mechanism, the scoops are withdrawn, leaving their charge of coal behind. As soon as the retorts are charged, they are closed by means of special self-sealing doors, and the charger is moved forward by its own engine to a position in front of the next series. The carbonization of the coal usually takes about four hours, at the end of which time the gases have been completely driven off, leaving practically pure coke behind. The lid of the retort is then opened and the coke is withdrawn by means of the discharger, which is driven up into position on the railway. This discharger is very similar in construction and operation to the charging machine. It has three long rakes arranged vertically, one above the other, at an elevation corresponding to that of the retorts. The rakes are thrust into the furnace and withdrawn by means of a steam cylinder 8 inches in diameter by 3 feet stroke operating a rack and endless chain and a drum. The rake is lifted as it enters the retort, in order to clear the fuel, dropped as soon as it reaches the back of the retort, and then withdrawn, bringing the charge of coke with it. During the process of distillation there is deposited on the inner surface of the walls of the retort a deposit of carbon known as "scurf," which is utilized in the electrical industries. Once in every six weeks it is necessary to burn out this deposit by means of air and steam until it is sufficiently thin to be broken with chisels and withdrawn.

The gas produced by the carbonization of the coal leaves the retorts by means of vertical ascension pipes, by which it is conveyed into a large horizontal half-round pipe known as the hydraulic main, which runs the whole length of the range, as shown in the engraving. The ascension pipes terminate in what are known as dip pipes, which descend a few inches below the surface of the collection of tar and ammoniacal liquor that fills the half-round bottom of the hydraulic main. The liquor is kept at a predetermined level by means of an adjustable overflow, which is shown just to the right of the hydraulic main. The gas enters the main through the dip pipe, bubbles through the liquid, and escapes from the main by means of a large pipe which conveys it to the condensers. The object of the dip pipe is to provide a seal which will prevent the return of any gas to the retorts. The tar and ammoniacal liquor, as they accumulate in the main, flow to the adjustable valve and are conducted through a trap to what is known as the tar and ammoniacal liquor well.

The condensers, which are shown in our engravings to the right of the retorts, are two in number. Each consists of a huge cast iron box 22 feet in height, 45 feet in length, and 6 feet in width, which is filled with a mass of vertical 4-inch tubes which extend between two tube sheets arranged a few feet from the bottom and from the top of the condensers, as shown in our sketch. Circulating water is kept continually flowing around the tubes, while the gases from the retorts are made to travel alternately up and down through the tubes until they have traversed the whole length of the condensers. The tubes are divided into groups of fifty-four, there being eighteen groups in each condenser. The gas enters at the bottom of the first group, passes up through it to the top of the next group, down through that group, then up through the next, and so on, until the series has been traversed. The gas enters at a temperature of between 110 and 115 degrees at one end, while the circulating water enters at 70 degrees at the opposite end, the gas finally leaving at 70 degrees, while the water escapes at the original temperature of the gas, of from 110 to 115 degrees. The cooling of the gas causes the vapors of the various hydrocarbons and the aqueous matter distilled from the coal to condense into the liquid form. We have seen that much of the heavy tar and some of the weak ammoniacal liquor was deposited in the hydraulic main, and the further cooling which takes place in the condensers results in the condensing of most of the strong ammoniacal liquor and some of the light tar. These liquid products collect at the bottom of the condensers, flow out along the bottom of the inlet pipe from the retorts, pass through a trap, and finally collect in the tar and ammoniacal well before referred to. In the two condensers there is a total cooling surface of 18,000 square feet.

At the opposite end from which it entered, the gas is led from the condensers by a large main and passes through what is known as the exhausters. Of these there are three at the Fourteenth Street works, two of which are constantly at work, the other being in reserve. The exhausters are simple Roots blowers, which serve to draw the gas through the condensers from the retorts and force it through the scrubbers and purifiers on its way to the holders. The exhauster, one of which is shown in our engraving immediately in front of the condenser, performs the double duty of relieving the pressure in the retorts, and producing the proper pressure in the holders for distribution through the city mains. The pressure in the retorts is maintained at about 1 inch of water, while the pressure in the holder is maintained at 7 inches.

From the exhausters the gas is forced through a large valve into the bottom of two huge circular towers technically known as "scrubbers." The scrubbers are in duplicate, and the following description of one will apply fully to the other. The tower, which is built of sheet iron, consists of an inner and an outer shell, this construction being adopted to guard against freezing in severe winter weather. The diameter of the inner shell is 13 feet, and its height to the platform is 62 feet, the total height of the structure over all being 84 feet. Down through the vertical axis of the tower extends a large 24-inch pipe for the return of the gas after it has ascended to the top of the tower. The space between the 24-inch main and the outer shell is filled with a vast number of slats of wood ¼ of an inch in thickness and 6 inches in depth. These are carried vertically on a series of superimposed radial arms, the object being to provide the largest possible amount of surface consistent with leaving sufficient space for the upward passage of the gas. At the top of the mass of slats is what is known as a "distributer," which consists of a rotating arm which extends entirely across the scrubber and is fed with a constant stream of water, which, as the arm rotates, is sprinkled evenly over the mass of slats below. The effect of this constant sprinkling is to keep the whole surface of the innumerable slats that fill the tower constantly wet, with the result that as the gas passes up through the slats it is thrown into intimate and thorough contact with the water and the ammonia gases are completely absorbed and carried down to the base of the tower, where they pass off through a trap to the ammonia well.

After leaving the scrubbers the gas is conducted through a large valve shown in the engravings to a series of purifiers, where whatever carbonic acid and sulphureted hydrogen remains is abstracted, together with some of the sulphur compounds. The carbonic acid must be removed, because it would lessen the illuminating strength of the gas, while the sulphureted hydrogen, for obvious reasons, must be completely taken out also. The purifiers measure 24 by 26 feet and 4 feet in depth. They contain a number of superimposed trays which are filled with oxide of iron and lime, the oxide of iron serving to remove the sulphur and the lime the carbonic acid. The gas is introduced at the bottom of the purifiers and passes up through the trays, finally leaving by way of the center seal valve, shown in the engravings. From this valve it is conducted to large water meters 15 feet in diameter and 12 feet in length, where its amount is registered. From the meters it passes underground through a main extending vertically into the center of the gas holder and terminating a few feet above the water level.

The gas holder, which not long ago was the largest of its kind in the country, is a huge affair 194 feet 6 inches in diameter and 165 feet in height when it is raised to its full lift. It is of the three-lift, telescopic type, and when it is down the whole of it telescopes into a large water-tank 42 feet in height, whose foundations are laid several feet below the surface of the ground. This tank has a capacity of 3,300,000 cubic feet. Huge as it is, however, it will be seen that it is by no means equal to accommodating the maximum output of the station, which, when everything is in full blast, amounts to 5,000,000 cubic feet per day.

In closing, it should be mentioned that the weight of the holder is not raised, as is often popularly supposed, by the lifting power of the gas, but by the actual pressure produced direct from the exhauster already referred to. This pressure is equal to about seven inches of water. The gas is led to the mains by the vertical pipe shown adjacent to the main by which the gas enters the holder. Before being delivered to the mains, however, the pressure is reduced to 3 inches for night consumption and 2 inches for day service.

Relative Corrosion of Wrought Iron and Steel.

At the recent International Engineering Congress on methods of testing construction materials, an address on the corrosion of iron and steel was delivered by H. M. Howe, the Honorary President. Mr. Howe, as the result of a long series of experiments, arrived at the following conclusions: First, that despite the common and widespread belief among engineers that soft steel corrodes much more rapidly than iron, there is really very little difference between the two in this respect, except where they are exposed to the action of salt water. If the corrosion of wrought iron be taken as 100, that of steel would be 114 in salt water; in fresh water, 94; and where the exposure is simply to the atmosphere, 103. In 3 per cent nickel steel the corrosion is about 80 per cent of that in wrought iron; in 26 per cent nickel steel, about 30 per cent. Although the latter metal has an enormous advantage over wrought iron, it cannot be called a non-corroding metal, but, rather, a slowly corroding one.

Photographing by Light from Venus.

Dr. William R. Brooks, director of the Smith Observatory at Geneva, N. Y., has succeeded in photographing objects solely by the light from the planet Venus. The experiments were conducted within the dome of the observatory, so that all outside light was excluded except that which came from Venus through the open shutter of the dome. The time was the darkest hour of the night, after the planet had risen, and before the approach of dawn. The actinic property of the light from Venus was much stronger than anticipated, the photographic plates being remarkably clear, intense, and fully timed. The experiments will be continued every clear night. Dr. Brooks was an early worker in photography, and has used it for many years in his astronomical researches.

Science Notes.

Prof. A. A. Michelson, of the University of Chicago, has been awarded a Grand Prix at the Paris Exposition for his echelon spectroscope.

After January 1, 1901, the Centigrade thermometer will be used exclusively in Germany, the Chancellor of the German Empire having issued an order to that effect.

Last year Berlin was visited by 1,000,000 strangers; Vienna, by 500,000; Munich, 600,000; Dresden, 500,000; Hamburg, Leipzig, and Zurich, each 400,000; while Düsseldorf, Bâle, and Stuttgart each had over 250,000 visitors.

The printing of the British Museum Authors' Catalogue is now completed up to the end of 1899. The compilation of this enormous work has occupied twenty years' incessant toil, and has entailed a total cost of $200,000. The catalogue comprises 400 large thick volumes and 70 supplements. The staff which has been engaged upon this work is now devoting its attention to the compilation of a subject index, which it is estimated will keep them fully occupied for another ten years.

The incessant vibration of the shutter in the biograph, necessary to impart the essential life-like veracity to the movements on the film, has been entirely obviated by a clever invention of a gentleman in London, Mr. Walter Gibbons, and his device is being employed in connection with the biograph at the London Hippodrome. By this new mechanism there will be no further irritation to the eyes of the audience, a drawback which is very painful after staring for some time at an abnormally long film.

Mr. Carl Linde, who has recently been giving great attention to machines producing liquid air, describes, in a recent issue of a German technical journal, a furnace designed by Mr. Hempel for an ingenious application of this substance. The furnace is intended to burn low-class fuel, such as lignite and peat, and the combustion is intensified by turning the gaseous mixture obtained by evaporating liquid air on the fire. Nitrogen is first set free, after which there remains a gas containing at least 50 per cent of oxygen. The price of this gaseous mixture is 81 cents per thousand cubic feet.

A curious effect of a bullet wound has just been exemplified in the Boer war. An English soldier in the storming of a position at the beginning of February last was struck in the face by a Mauser bullet. The projectile lodged in the head somewhere, but all attempts to reveal its precise position by the X-rays were futile. The soldier was discharged from his hospital as cured, and participated in several other battles. The only ill effect he experienced from the wound was a slight impediment in his speech. On July 11 he was seized with a violent attack of sneezing, and during his exertions disgorged what proved to be the missing bullet. It had been firmly embedded point downward in the lower part of his jaw.

Dr. A. Baginsky has recently visited Odessa, and during his sojourn in that district visited the "limans," which are in the vicinity of that port. The "limans" are vast sheets of water, which were originally connected with the sea, but through gradual silting up of sand have been isolated and are now extensive salt water lakes. By means of evaporation the waters in these lakes have become concentrated, and have been proved to be of such therapeutic value that the "liman cure," as it is called, is rapidly growing into popular favor. At the Kujalnitzki liman, about six miles distant from Odessa, and which is the most important liman, as many as 232,318 baths were taken last season, and the patients reaped appreciable benefits from this course of treatment. Thirty-three per cent of the patients were sufferers from chronic articular rheumatism; 495 were scrofulous; and 254 anæmic.

On the first of September M. Jacques Faure, a member of the Aero Club of Paris, crossed by balloon from the Crystal Palace, London, to France. He set off on his journey at six o'clock in the evening, and safely descended at Alette near Boulogne at ten minutes to eleven, the journey having occupied four hours and fifty minutes. The balloon traveled almost throughout the entire distance at a height of 2,000 feet. This is by no means an exceptional performance, since Mr. Percival Spencer, the well known aeronaut of London, has crossed from the Crystal Palace to France on several occasions with varied success, but the trip has never before been attempted by night. The advantage of the night journey is that the air being condensed does not rarefy the gas in the balloon, as is the case when the sun's rays are directed upon the vessel during the day time. So long as the temperature of the atmosphere remains at a certain point, the balloon will maintain its equilibrium at a regular altitude. M. Faure intends to recross from France to England, starting from Cherbourg, with the first suitable wind. On this occasion, special floats will be attached to the balloon, so that, in the event of its unexpectedly descending into the water, it will be kept afloat.

Engineering Notes.

Paris is experimenting with oil lamps for the street. They are a thousand candle power each and are set up on the river side of the Tuileries garden.

A Western road has a flat car equipped with an air compressor and boiler to operate a sand blast for cleaning bridges and iron structures preparatory to painting.

A new steel process is being tested at Pittsburg, for making compound steel ingots. The experiments are being made under the direction of W. D. Corcoran, of the Crucible Steel Company, of America. Solid ingots of graduated carbon, from one side of the ingot to the other, or from the center of the ingot, were made. It is claimed that the new process will be important for armor plate, as any desired thickness of very high carbon can be given the surface of the plate, rendering it, with a low carbon back, absolutely impenetrable.

A report has recently been published upon the coal fields of China, and those around Tse-chau were recently visited by Prof. Drake, who found that the workable coal lies in one bed about 250 feet above a flint-bearing limestone stratum, below which there may also be coal. The thickness of the same is probably not less than 22 feet and at one place it is worked through a shaft 329 feet deep. Prof. Drake estimates that within 150 square miles around Tse-chau there are about 3 000 million metric tons of coal. Most of Shan-si has been found underlaid by large coal beds. It is also considered that the anthracite coal alone of Shan-si amounts to 3,000 million metric tons, and that the coal area is greater than that of Pennsylvania. Nearly all the coal is mined through shafts varying from 50 to 300 feet. No steam is used for raising the coal to the surface, and explosives are not employed. Very little coal is mined through inclines. For local use coal is taken away in carts drawn by oxen. It is practicable in the Shan-si coal beds to run long lines of railroad tunnels through the bed and load the cars in the mines for distant transportation.

Some particulars of cellulith are given in La Revue de Produits Chimiques. It is well known that in the making of paper, a continuous beating of the pulp produces a transparent and elastic mixture, which hardens on drying and greatly strengthens the paper. The cellulith is prepared by a process exclusively mechanical—the beating of the pulp for a much longer time than is necessary in the production of mere paper. According to the properties of the pulp and the rate of revolution of the cylinder, the operation may last from forty to one hundred and fifty hours, or until there is a homogeneous mass having no trace of fiber. The air in the substance is removed by beating for two more hours; if allowed to remain, it might destroy the regularity of the material. If desired, suitable colors are added, and then the substance is heated, the hot cellulose liquor passing into a vessel having a perforated bottom, through which it drips. Containing 96 per cent of water, the material has the consistency of thick honey. The water is evaporated either by natural or artificial heat, and the pulp hardens, gradually attaining the consistency of horn, its specific gravity being about 4·5. The cellulith may be worked as is horn or ebonite. Combined with sawdust and 30 per cent lampblack, the result is a kind of dark ebonite; this is dense and may be polished.

The efficiency of the steam turbine motor for the propulsion of such craft as torpedo-boat destroyers has been amply demonstrated, first with the little "Turbinia," and more particularly by the "Viper," which has passed through her official steam trials under the direction of the Admiralty officials with pronounced success in every respect, attaining on a three hours' trial the satisfactory speed of 33·838 knots. More could probably have been done, but this more than satisfied the contract conditions. The only point remaining to settle had reference to the economy of the steam turbine in comparison with the reciprocating engine; and the results are now available. As the power developed could not be determined, the only measure for fair comparison is the consumption per hour for a given speed. On a three hours' trial at 31·118 knots the "Viper" burned 8·86 tons of coal per hour, or 19,846 pounds, and on a three hours' trial at 33·838 knots the consumption was 11 tons 9 hundredweight 1 quarter 9 pounds, or 25,685 pounds per hour. The "Albatross," which was built and engined by Messrs. Thornycroft, is the only destroyer with reciprocating engines which has on official trials made a speed approaching to that of the "Viper," and here the speed was 31·552 knots, with the engines indicating 7,732 indicated horse power. The displacement of the "Albatross" is 384½ tons, and of the "Viper" 385 tons; while the coal consumed per hour for 31·552 knots for the former was 17,474 pounds per hour, and for 31·118 knots of the latter 19,846 pounds per hour, so that here is a fair basis of comparison which requires no comment. The 30-knot destroyers, with reciprocating engines, consume about 15,150 pounds per hour, this result being the mean of 45 boats.—The Engineer.

Electrical Notes.

The first electric street railway line in London proper will probably be built on the Victoria Embankment of the Thames from Blackfriars Bridge to new Battersea Bridge.

In the plant of the United Electric Light and Power Company of New York the largest steam turbine ever built is about to be installed. The normal output of the turbine will be 2,500 horse power, but it will have capacity sufficient to carry a 3,000 horse power load. The turbine will be direct-coupled to an alternating current generator rated at 1,500 kilowatts, or capable of supplying 30,000 sixteen candle power incandescent lamps.

An invention which is much needed at the present time is a telephone meter, attached to each subscriber's instrument, so as to show accurately the number of telephone connections made for the subscriber, or the total length of time the line is used on outgoing calls. Such a meter to be successful must be simple and easily read. It must also register accurately all connections actually obtained, and must not interfere with the necessary talking and signaling circuits. It must not involve any additional complication at the switchboard. If such a meter could be produced at a moderate price, it would be sure of success.

Sir William Preece read a most interesting paper before the British Association at the Bradford meeting, in which he stated that the first experiments in regard to wireless telephony were made in February, 1894, across Loch Ness, in the Highlands of Scotland. On that occasion trials were made to determine the laws which govern the transmission of the Morse signals by the electro-magnetic method of the wireless telegraph. Two parallel wires, well earthed, were taken one on each side of the lake, and arrangements were made by which the wires were systematically shortened with a view to ascertaining the minimum length necessary to record satisfactory signals. The trials show that it was possible to exchange speech across the loch at an average distance of 1·3 miles between the parallel wires, and the length of the wires themselves was reduced to 4 miles on each side of the water. The volume of telegraphic current was immensely greater than that of the telephonic current. Whenever through want of balance in a loop disturbance was evident, telephonic cross talk was also evident.

The Chief Inspector of French Telegraphs, M. Willot, has communicated a paper to the Electrical Congress in which he states that it is his belief that ether wave telegraphy will soon become obsolete. He is a well-known electrician and inventor of telegraph and telephonic devices. He has come to the conclusion that it is the earth, and not the air, through which signals are transmitted, without the use of wires, and that the curvature of the earth and intervening hills do not intercept the signals, and this suggested to him the question whether the matter telegraphed left the masts at the top or bottom. He believes that it left at the bottom, as the signaling is not affected by wind or fog, and is improved by giving the masts good electrical communication with the earth. According to his theory, communication is kept up through geological beds, in which the electricity of the earth has the same tension, so that any disturbance on one point at the same electrical level creates a swell in the lower level, leaving the higher and lower strata comparatively undisturbed. He proposes to tap these levels by means of shafts and measure the electrical tension with the electroscope. The French Telegraph Department has appointed a committee to sink the shafts to ascertain the distribution of electrical levels. M. Willot considers that he can construct an apparatus which will meet every case.

In the course of some experiments on liquid air, H. Ebert and B. A. Hoffmann noticed that a body suspended above the surface of the liquid acquired a strong negative charge. A series of test experiments revealed the fact that this charge is not due to the liquid air itself, but to the friction of minute particles of very cold ice suspended in it. The authors even succeeded in constructing a kind of electrifying machine by means of a tube containing a piece of wire gauze through which the vapor of liquid air was driven. This phenomenon of electrification should be allowed for in all experiments with liquid air, as it may account for many errors and anomalies. Ice acquires a positive charge by friction with any metal, and imparts to the metal and other bodies also a negative charge. It appears to be the more active in this respect, the colder and the drier it is. This may account for the strong electric effects of polar snowstorms. Even in our latitudes, ascending currents of air soon reach elevations at which all their water freezes, and the friction of the ice crystals against suspended dust particles would account for part of the atmospheric electrification. In the highest regions, a friction between atmospheric ice and cosmic dust, together with solar ionization and the consequent conductivity of the atmosphere, might account for the luminescence often observed, and even for the aurora.—Ebert and Hoffmann, Ann. der Physik.

ALEUTS OF THE ALASKA PENINSULA.

The aborigines of the Alaska peninsula were once the most numerous of all the tribes of the territory. In enterprise, courage, ingenuity and intelligence, they were acknowledged, by the early discoverers, to be superior to all the tribes of Alaska. Their number, a hundred years ago, was far beyond that of the present time; disease and drunkenness, both introduced by the whites, would long since have exterminated these interesting people but for the efforts of missionaries of the Greek church, who have worked indefatigably to reform and preserve the remnants of this once powerful race. On the mainland, near the Shumagin group, there is now a considerable settlement of Aleuts, called Bellkofsky, ruled by a Russian priest. Before the American occupation the vicinity was the haunt of the sea otter, and large quantities of the fur of these and other animals were annually harvested. The Aleuts were skillful hunters, and the Russian government used to furnish supplies in exchange for furs. The country round about produces nothing in the shape of vegetable food, and the people relied upon the chase and such food fish as they could cure during the short season to supplement the rations issued by the Russians.

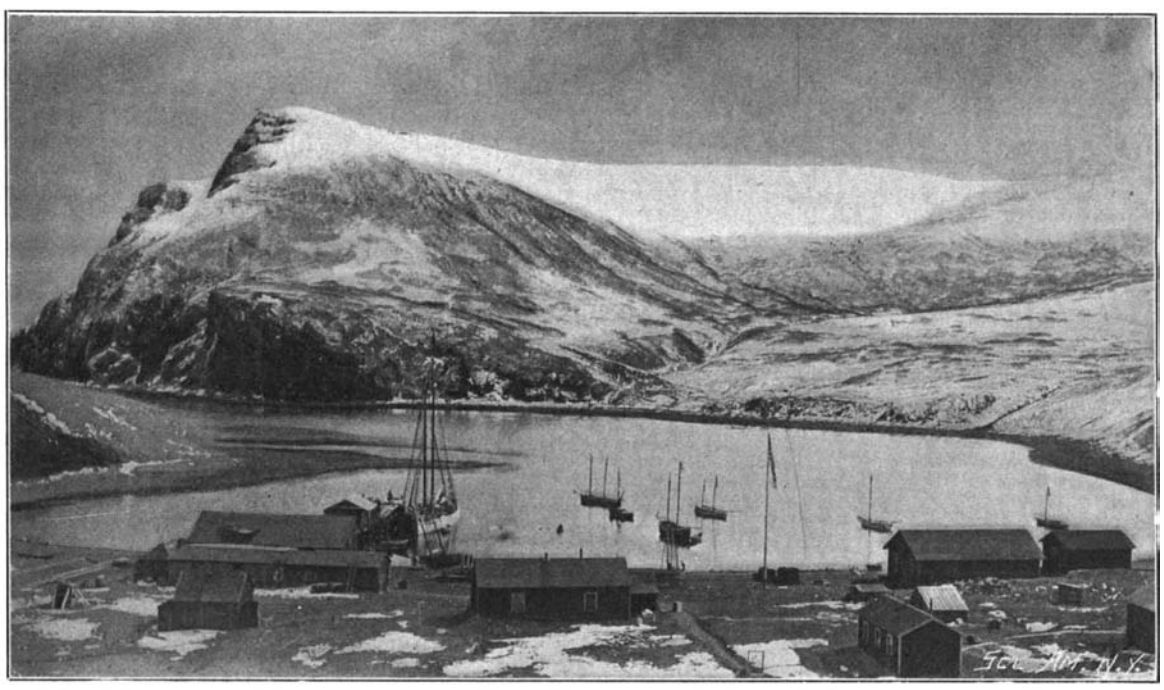
GROUP OF NATIVE WOMEN AND WHITE HUSBANDS.

The disappearance of the food-bearing animals owing to persistent slaughter has thrown the Aleuts in a great measure upon their own resources. Existence is becoming more difficult to them. They are skillful fishermen and know the best haunts of the fish. They go in a body to certain points where temporary huts are constructed, and during the run they catch and cure their stock for winter. The salmon oil for consumption and light is preserved in receptacles made of whole sealskins. The fish are dried on racks made of drift wood. The dwellings of the tribe are ingeniously constructed and extremely comfortable. An excavation to the depth of a few feet is made, and then a frame of drift wood (they have no other timber) is erected and inclosed by sod on roof and sides. To prevent the earth blowing away during the violent and frequent storms, the top of the house is covered with a net made of grass, which is stretched tight and fastened down with pegs. A structure of this kind is known as a "barakary." Many white men reside with these Aleuts; but marriage by the priest is compulsory.

In the construction of their native boats, or "bidarkas," the Aleuts are extremely ingenious and they manage them with wonderful skill. The bidarka differs from the kyak of the Esquimos in having more than one hatch (in some cases as many as three) and in being propelled by double-bladed paddles. The kyak has but one hatch, and the occupant uses a single-bladed paddle, which is dipped first on one side and then on the other. The bidarka is made of a frame of wood, covered over with the skin of the sea lion. The hatches are circular and are made tight by a skin covering, which is drawn around the waist of the occupant. The Aleuts accustom themselves from youth to manage the bidarka. A child just learning to walk is taught to sit in a toy craft and encouraged to learn to paddle. The highest honors of chieftainship are conferred upon the best "oarsman." In these crafts the most powerful of storms is fearlessly encountered. Sitting in the confined space of the bidarka, from early youth, has a strong influence upon the physical development of these people. Above the hips they are powerful and stalwart; below, misshaped and disproportioned.

A THREE-HATCH "BIDARKA," NATIVE CANOE.

Pirate Cove on Popof Island, one of the Hunnagin group, in addition to being one of the stations of the codfishing industry, has a name which is of particular historic interest in connection with the native Aleuts. The name of the cove is derived from an incident which happened a century ago. A body of Aleut Indians once made the cove a haunt, from which they emerged at intervals to harass the people of the neighboring coasts. For many years these pirates continued their devastating warfare, until the mainland within a hundred miles of the cove was practically depopulated. A strong expeditionary force was organized under the leadership of the Russians, which was successful in surprising the pirates in their stronghold. To the last one they were exterminated, and even to this day the skeletons of these bloodthirsty people, together with relics of their occupation, are dug up. The cove, of which we present an illustration, is about half a mile across and access is gained to it through a very narrow entrance. Daily the fisherman starts out in his dory and returns with his catch to the warehouse, where it is cut up and prepared for shipment on the arrival of the tender. The latitude of the island is about that of Edinburgh and Moscow, and the climate is relatively high, the lowest temperature record for the fishing season of 1899–1900 being —4°. There is no vegetation upon the island, and even the hardiest vegetables will not mature. The rainfall is enormous. It may be mentioned that in 1899 the Alaska catch of codfish aggregated 1,302,000, averaging a rate of two tons to the thousand, or 2,600 tons in all.



PIRATE COVE, POPOF ISLAND.

Electrical Energy by Steam and Gas Engines.

In a communication recently presented to the Société Electrotechnique of Hanover, Prof. Krone has established a comparison between the cost of electric power produced by steam and by gas. He has calculated the expense of a steam engine, with or without condensation, including the interest, etc., and the service. To this he adds the cost of an electric installation for 100 horse power. According to his figures, the cost of a horse power hour (electric) is $0·026 with an non-condensing engine, and $0·024 with a condensing engine. If a gas engine is used, the cost is found to be $0·020 for the same unit under similar conditions; the saving is thus 16 per cent, based upon the best of the steam engines. The author describes a small electric station installed at Clausthal; it has two gas generators and two gas engines of 70 horse power each, making 140 revolutions per minute; the speed may be increased 15 per cent when it is desired to charge a battery of accumulators. The gas engine is regulated by varying the quantity of the detonation mixture introduced, the proportion of the mixture remaining always the same. The gas engine runs with great regularity, as may be observed by the fact that when one-half its load is thrown off, the speed does not rise more than 3 per cent. These engines are connected directly to two direct current dynamos of 46 kilowatts each. During one year the amount of combustible, anthracite and coke mixed, which was necessary to produce one horse power hour of electric energy averaged about 2·3 pounds.

A FRENCH newspaper gives a dispatch from Marseilles stating that five of the great steamship lines are negotiating with a view to diminishing the number of voyages by about one-half. It is said that they are taking this step because of the advance in the price of coal.

A UNIQUE PIGEON POSTAL SERVICE.

The homing and carrier pigeons have on more than one occasion displayed their remarkable innate proclivities for the quick conveyance of messages between different points when other systems of communication are either unavailable or have broken down. In the Franco-Prussian war they were used by the unfortunate imprisoned citizens of Paris to carry messages to the outside world. In the present Boer war they have been freely employed, especially during the siege of Ladysmith. Then, again, since the foundering of the French steamer Bourgogne with her four hundred souls off Newfoundland some months ago, the various French shipping companies have been conducting several experiments with these pigeons, with a view to employing them to carry news of any accident that may have occurred to the steamer during her voyage, thus explaining to the anxiously waiting relatives of the passengers ashore the safety of the vessel, the reason for her delay, and other interesting information. But in New Zealand a much more novel and enterprising attempt has been made to introduce the pigeon into the commercial world by establishing a pigeon post between Auckland and Great Barrier Island. Great Barrier Island lies about sixty miles north of Auckland. It is a bleak, inaccessible spot. The mines supply the most important means of support to the few inhabitants who eke out their existence on this lonely island, with no other means of communicating with the mainland than by the steamer, which calls only once a week. Their complete isolation has been forcibly brought home to the islanders on more than one occasion. Some months ago a terrible shipwreck occurred on its formidable coast, and though within so short a distance of Auckland, the news of the catastrophe was not known in the latter town until four days after it had happened.

NEW ZEALAND PIGEON POSTAL SERVICE—THE BIRDS' HOME QUARTERS.

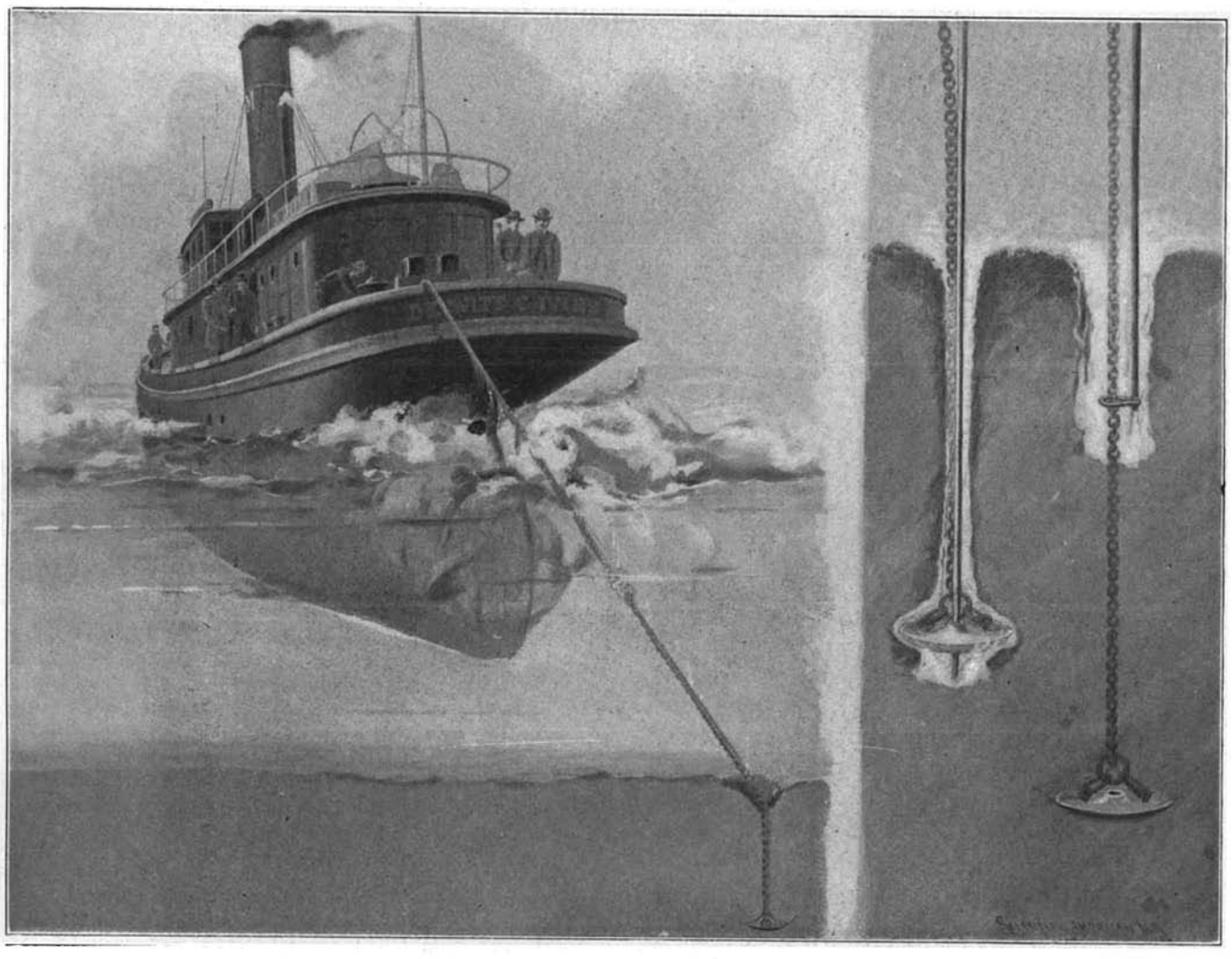
In 1896 the island was imbued with a new lease of life through the mining industry increasing, owing to the efforts of one or two influential gentlemen on the mainland. The result was that a number of families of miners traveled to the island to participate in the prosperity. It was also recognized by one gentleman, Mr. W. Fricker, who was an ardent pigeon fancier, that a quicker means of transit should exist for the conveyance of news, correspondence, etc., between the island and the mainland. He thereupon established his pigeongram agency. The birds were housed in comfortable quarters on Great Barrier Island, and were soon sufficiently trained for the purpose of carrying messages to the town of Auckland. The value of this unique agency was immediately realized, and it was enthusiastically and substantially supported by the shipping company and several other mine owners and merchants who were greatly interested in the development of the island. At first, the birds were only trained to fly one way. That is to say, they were taken by boat to Great Barrier Island, and liberated as the exigencies arose, when they immediately set out toward their home at Auckland, and were returned to the island in crates by the weekly steamer. The disadvantage of this method is obvious. It was possible to carry messages from the island to the mainland, but no communications could be conveyed from the mainland to the island. Mr. Fricker, realizing this drawback, immediately commenced to train other birds to accomplish the reverse journey from Auckland to Great Barrier Island, and now it is possible to dispatch a message either way with the assurance that a reply will be forthcoming in a very short time.

The time generally occupied on the journey by the birds averages from 65 to 70 minutes; but, as may be naturally supposed, their rate of traveling depends upon the condition of the wind and weather. When the service was first inaugurated, the cost of transmission was 50 cents per message; but when the circuit of communication was completed, and it was found that one bird could carry four messages at a time, the cost was revised. Now the cost of carrying a message from the island to Auckland is 12 cents, and 25 cents for the reverse journey. The reason that it costs more to carry a message from Auckland to the island is due to the fact that the training of the birds for this route was more laborious, since strong persuasion had to be brought upon the birds to induce them to face the long water journey. The messages are written upon tissue paper with carbon leaf. The paper is perforated down each side. When the message has been written it is folded and sealed with the agency's stamp, which secures complete privacy of the communication. The message is then wrapped round the bird's leg and covered with a waterproof legging, which serves to protect the message from injury during wet weather, and also to prevent the bird's picking it to pieces. When the bird enters the terminus at either end, he passes through the usual trap which is generally provided to the lofts of homing pigeons. In this case, however, the trap gives entrance to a kind of small ante-loft. The trap, in falling, rings a bell, which notifies the attendant of the arrival of a bird. He thereupon takes the bird out of this ante-loft, removes the message from its leg, and then permits the pigeon to enter the main loft. To open the message it is simply necessary to tear the perforation.

The service is well supported, considerably over one hundred birds being retained as messengers. It is officially recognized by the New Zealand government and the Imperial government as a bona-fide postal service between the island and Auckland. It issues its own postage stamps for franking the messages. It is a reliable, rapid, and cheap means of communication. Even when the telegraph cable eventually connects the island with the mainland, it is extremely improbable that it will fall into desuetude, since the number of words that can be written upon the tissue paper and transmitted for 12 cents—the same message would cost ten or twelve times that sum if dispatched by cable—will recommend its utilization in lieu of the telegraph.

THE LANGSTON MOORING DEVICE.

The Langston mooring device, which bears the name of its inventor, is designed to afford absolutely secure anchorage for vessels and buoys under extreme conditions of storm, ice pressure or other sources of violent strain. As represented in the accompanying engravings, it consists of a cast iron disk of any desired diameter, from 10 inches up to 2 feet, on the concave surface of which strong lugs are forged for the holding of triple rings to which a chain may be attached by a shackle. To sink the device, the nozzle of a 1½-inch galvanized pipe is passed through a hole



Ocean Tug Attempting to Start the Disk.

Method of Lowering and Removing the Disk by Means of the Hydraulic Jet.

THE LANGSTON MOORING DEVICE.

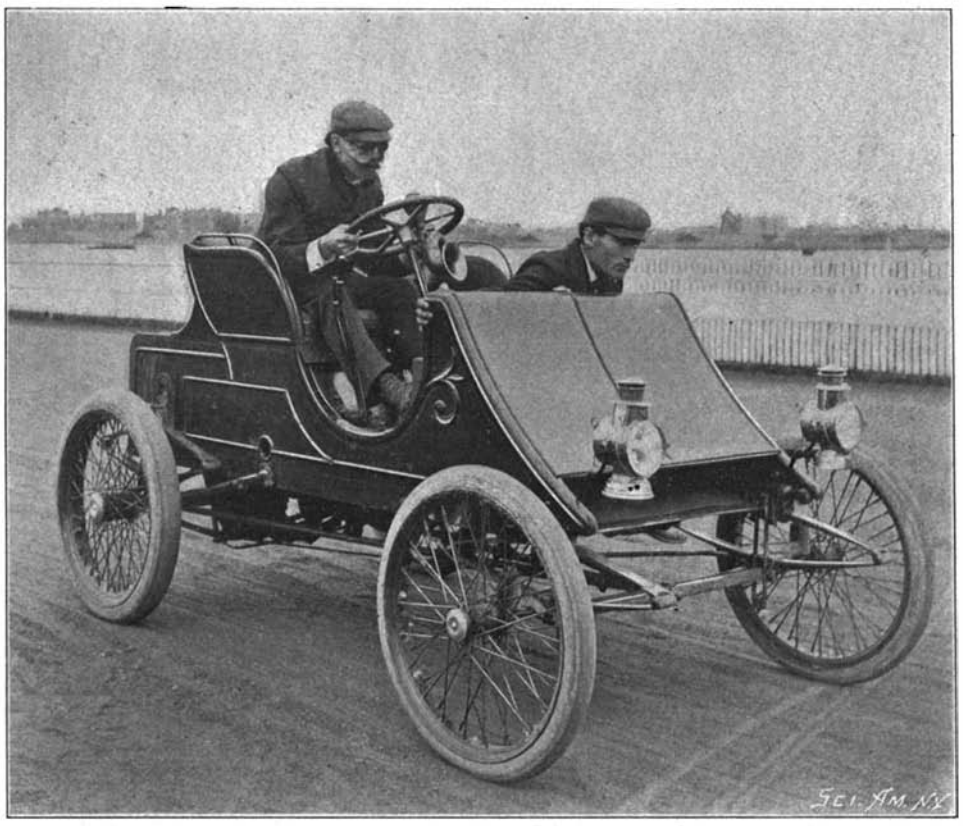
which is bored through the center of the disk. At the upper end of the pipe a hose is attached by means of an inverted U connection (this form being used to prevent cramping), and by this means a stream of water is forced to the under surface of the disk by means of a hydraulic pump. The chain is stopped to the pipe to keep the disk firmly on the nozzle, and the whole apparatus, pipe, hose, chain and disk, is supported from a davit or gaff and, therefore, easily maintained in a vertical position. The disk is lowered to the bottom until it rests upon the sand or other material in which it is to be sunk, when the pump is started. The stream of water, passing through the disk to its under or convex side, loosens the sand and allows the disk with its pipe, chain, etc., to sink into the vertical hole, which is thus continually being washed out as the apparatus descends. The apparatus being supported from a davit in the way described, it is practicable to lower the pipe to the bottom in any depth of water where anchorage may be desired, the pipe merely being long enough to steady the disk in the hole which is bored in the sand or mud of the bottom, and put a disk down from 10 to 30 feet or more below the bottom. When the disk is at the proper depth, the stoppings of the chain are cast off, by releasing a clutch, and the pipe is withdrawn. The disturbed material immediately settles back on the disk and around the chain, burying it firmly in place. It can be readily seen that the holding power of this form of anchorage is enormously greater than that which can be obtained by means of the plow point of an ordinary fluke anchor or the broad lip of a mushroom anchor, whose hold upon the sand or mud is merely superficial.

In the gale which visited New York on September 5 last, when the wind attained a velocity of 65 miles an hour, striking evidence was afforded of the efficiency of this form of anchor. It seems that eleven of these disks, which have been sunk in the mooring grounds of the Brooklyn Yacht Club and vicinity, did yeoman service, not merely in holding the particular yachts that were made fast to them, but in saving three or four other boats that had dragged their anchors from being cast ashore. Forty other yachts which were not so secured dragged their anchors of the ordinary type, and were piled up on the beach between Ulmer Park and Fort Hamilton.

It was natural that this device should commend itself to the attention of the Navy and the Lighthouse Board. There are along our coast no less than 44 light vessels and 5,000 channel and coast buoys. The number of buoys that are torn adrift from their moorings every year is such as to warrant the department in investigating every new device that promises to afford a more secure means of anchorage than is at present available. Apart from the financial loss that occurs in the displacement and loss of buoys, which by the way frequently cost several hundred dollars apiece, there is the serious risk to navigation—a much more serious matter. The value of an absolutely secure form of anchorage to the navy is also obvious, for there are many locations where naval vessels can find but poor holding ground for anchors of the ordinary type. Realizing the possibilities of the Langston mooring, the Lighthouse Board and the Navy Department detailed officers to observe and report upon the practical demonstrations of its utility in New York Harbor. The last of these tests was made on September 15, at a point a little distance offshore from the Atlantic Yacht Club house at Norton's Point.

The experiment was carried out with a 12-inch cast iron disk, which was put down through water 18 feet deep, to a depth of 8 feet, in a bottom of sand and clay. The time required from the starting of the force pump until the sinking was complete was 6½ minutes. A ⅝-inch crown chain, 15 fathoms in length, was attached to the disk. The accompanying illustrations show very clearly the action of the water in cutting away the sand and clay below the disk and excavating the vertical shaft at the bottom of which the disk was deposited. The sand, etc., closes in somewhat upon the chain and pipe as the disk descends, but upon the withdrawal of the pipe the discharge of the water loosens the surrounding material sufficiently to allow of the easy withdrawal of the pipe, after which the material closes in quickly and solidly above the disk and around the connecting chain, as shown in the illustration.

Sixty minutes were allowed for the filling in of the hole, which, while it was probably not sufficient for the completion of the process and the thorough settlement of the loosened material, sufficed, as the test afterward showed, for all practical purposes. A new 7-inch hawser was attached to the chain, and 25 fathoms were paid out and made fast to the towing bits of the ocean-going tug "DeWitt C. Ivins," the newest and most powerful vessel of the Moran towing fleet. The tug has a compound engine with cylinders of 15 and 30 inches diameter by 22 inches stroke, and the boiler carries 140 pounds of steam pressure. The propeller, which is 8 feet 6 inches in diameter, was turned at 105 revolutions, and this was subsequently increased to 120, a rate which was maintained up to the conclusion of the test, or for a period of twenty-one minutes. The tug failed to produce the slightest effect upon the stability of the buried disk, and it was the unanimous opinion of the officials who witnessed it that the demonstration was completely successful. Although the holding power of the device is so great, the removal of one of these disks is a very simple matter. The hose is brought into requisition, and a double ring, shaped like the figure 8, is fitted tightly to the lower end of the hose and loosely on the mooring chain, down which it slips. As the pipe descends, the stream of water speedily cuts its way through the sand, opening a way for the pipe, until, guided by the chain, it reaches the disk, which may then be drawn up without difficulty.



MR. ALEXANDER WINTON IN HIS RACING MACHINE ON THE WASHINGTON PARK TRACK, CHICAGO.

CHICAGO AUTOMOBILE EXHIBITION AND RACE MEET.

BY ARTHUR T. KELLOGG.

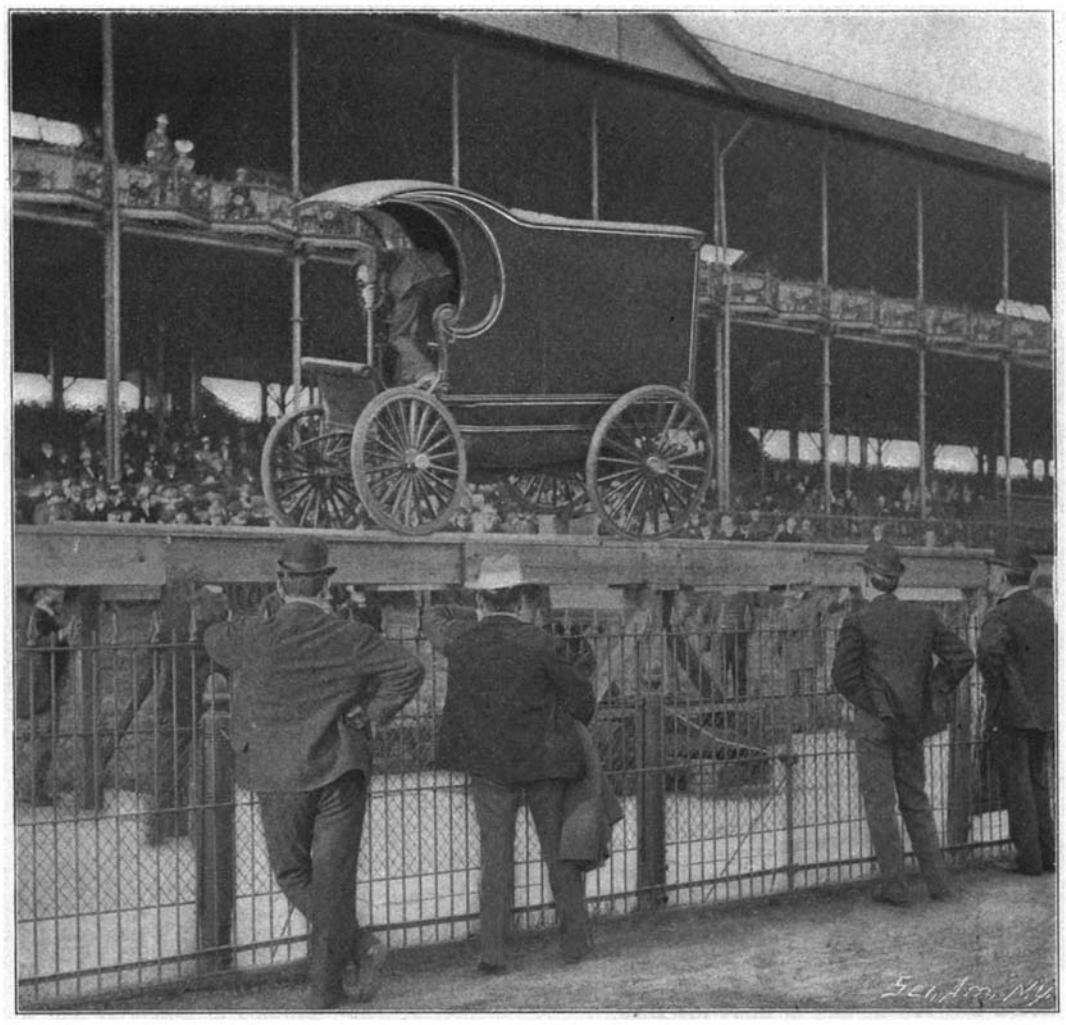
The automobile exhibition and race meet promoted by The Chicago Inter-Ocean, while an interesting affair, fell short of being the success for which the promoters and all interested in automobiles hoped. The exhibitors of complete automobiles numbered twenty, of whom eleven showed vehicles or cycles propelled by hydrocarbon motors; five exhibited electric vehicles, and four steam vehicles. The steam vehicles were all very much alike, not only in general appearance, but in their mechanical construction. All had fire-tube boilers, with about 300 tubes; two-cylinder, single-acting, vertical engines, and burners fed with vaporized gasoline and working on the Bunsen principle. One firm had two racers on the grounds, which showed themselves remarkably speedy over comparatively short distances. Within fifteen yards they would be going at full speed, in contrast to the electrics, which were much slower, and in still more marked contrast to the gasoline vehicles, which took an eighth to a quarter of a mile to attain their best speed. One of these little steam racers was reported to have gone a mile in 1 minute and 6 seconds. This time was not official, however.

The electric vehicles were, by all odds, the handsomest vehicles in the show, judged from the standpoint of a carriage builder. One make is equipped with an electric brake which worked admirably. Another make is notable for having motors which work at higher pressure than that generally accepted as the correct thing. This necessitates the use of more than the usual forty cells to the vehicle, which forty cells can be charged from the 110-volt, direct current circuit, such as is common in the larger cities. The use of a greater number of cells necessitates the use of a booster, or, as the exhibitors preferred to call it, a "motor-generator."

The high pressure automobiles carried off the majority of prizes offered for electric vehicles, thus showing them to be of high efficiency.

The eleven makes of gasoline vehicles differed widely from each other. Almost the only feature common to them all was that they all employed the four-cycle principle in their motors. The speediest vehicles on the grounds—for any considerable distance, at least—were among these gasoline vehicles. Of these, the speediest of all were the little tricycles, all built on the accepted French lines. While these little vehicles were speedy, they proved themselves unreliable.

Among the larger vehicles there was only one machine that made any pretensions to speed sufficiently high to make a showing against the little tricycles, and that was the racer with which Alexander Winton vainly attempted to win the championship of the world in France this past summer. It ran with a commendable consistency, unlike the tricycles, never showing a greater variation than ten



AUTOMOBILE DELIVERY WAGON BREAKING AN EGG PLACED ON A BOX, THE WHOLE BEING SUPPORTED ON A TEETER-BOARD.

seconds between the fastest and slowest mile in a fifty mile jaunt. This machine covered fifty miles in 1 hour 17 minutes and 50 seconds against 1 hour 15 minutes and 57⅘ seconds for one of the tricycles.

The other gasoline vehicles were of various types. They were designed for use on public roads, and were not equipped with sufficient power or sufficiently high gears to make a creditable showing against the racing machines. One thing was noticeable, and that was the tendency to equip these vehicles with motors of higher power than is ordinarily needed, and of regulating the speed of the vehicles, principally through controlling the speed of the motors by varying the amount of the explosive charge and the time of firing that charge. This, of course, does not permit the motors to work at their highest efficiency except during a small portion of the time. Almost all were equipped with reducing gears to facilitate hill climbing and progress over exceptionally bad roads. The road-going qualities of these vehicles are attested by the fact that two made the journey from New York to Chicago on their own wheels and two others made the trip from St. Louis to Chicago in the same manner.

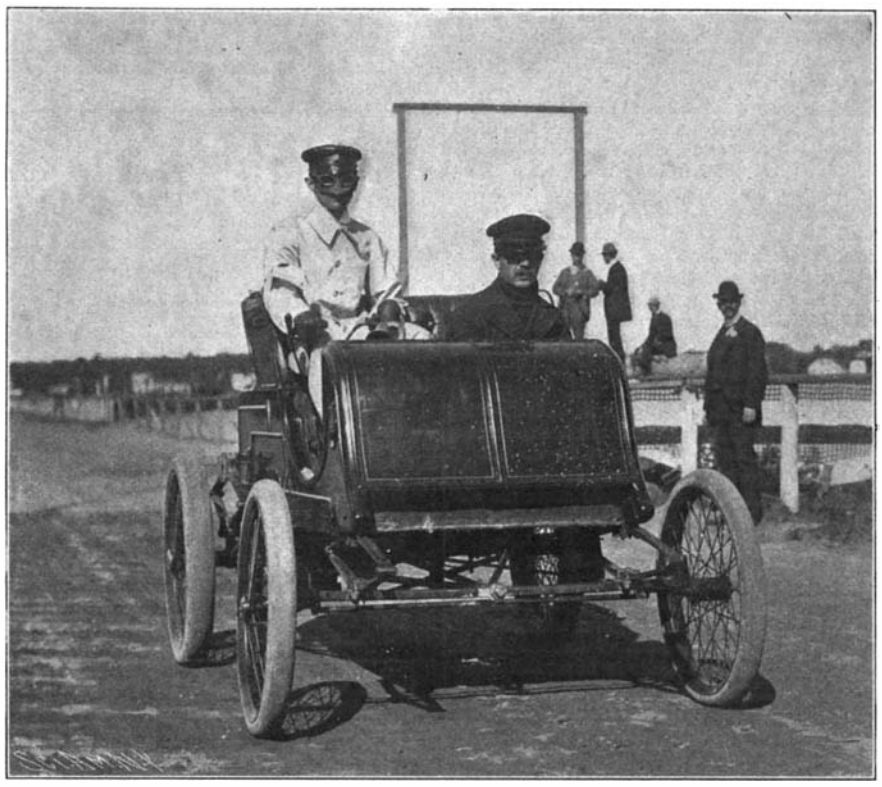
There was one make of gasoline vehicles exhibited that performed some remarkable feats, designed to impress the spectators with the perfection of control which has been obtained. These feats consisted in climbing the grades, in turning and maneuvering in remarkably close quarters, in wandering over a three-foot pile of loose timbers, and in performing a number of feats on a "teeter board." This teeter board consisted of a number of stout timbers spiked together so as to form two runways twelve inches wide. These two were braced together at a proper distance to accommodate the gage of the wheels, and were laid over a stout support, some eight feet high. With one end of this teeter resting on the ground and the other high in air, the vehicle would start up the incline, stopping at the center in such a position as to balance the teeter.

After the vehicle had played "see-saw" all by itself for a while, stevedores would put supports under either end of the teeter, a roller would be placed under one of the rear wheels of the vehicle, and it would be driven back and forth within such narrow limits as to keep the wheel on the rolling piece of wood. Then a ten-inch cube of wood would be substituted for the roller, and the vehicle would be made to climb back and forth over it, or to stop with the wheel in apparently impossible positions. To cap the climax, the vehicle would be backed over the block of wood and lowered until it was just close enough to the teeter board to crack the shell of an egg placed by an attendant, without doing more damage to it. All these feats were performed in the presence of hundreds of spectators. The vehicle is equipped with a powerful motor and friction transmission. In climbing grades the steam and gasoline vehicles showed themselves capable of overcoming grades of from 25 to 40 per cent. None of the electrics attempted a trial on the artificial grades.

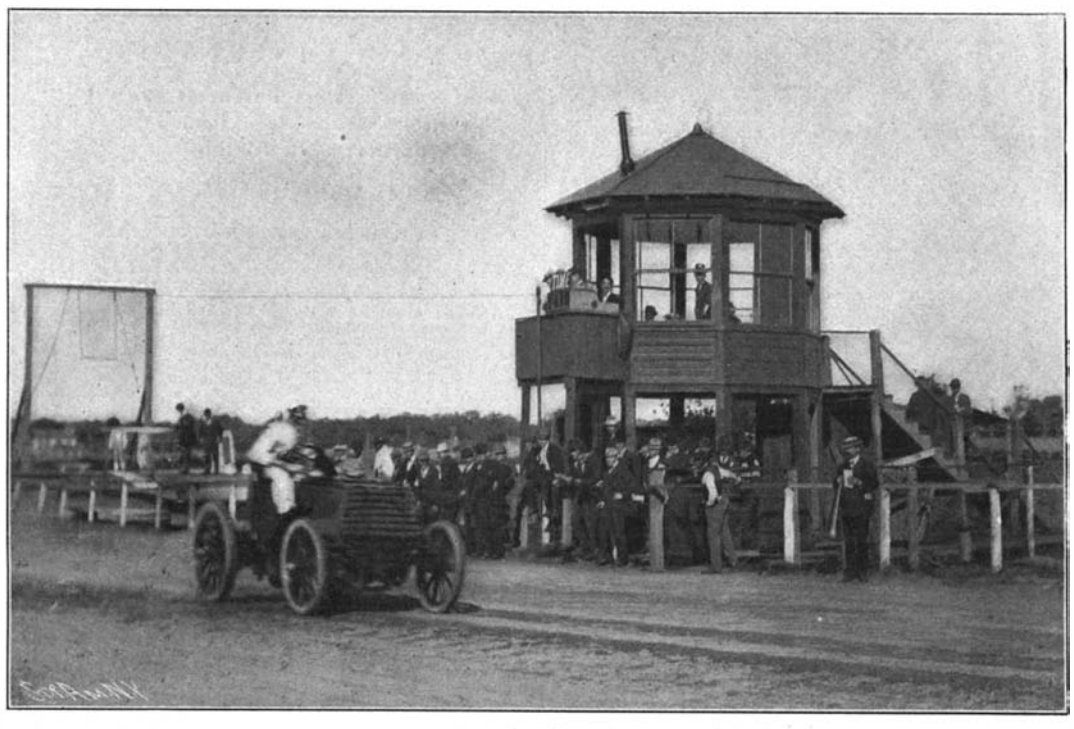
In the races none of the electrics entered for any contest of more than five miles in length, and the steam vehicles — the little racers, at least—could not be dragged into an event of more than ten miles in length. In a five mile contest between road machines the three types of vehicles were all represented for the only time. An electric led for two miles, when it was passed by a steam runabout, which held its lead to the finish, although being rapidly overtaken by the electric at this point. The steam machine started with a steam pressure of 225 pounds and finished with 25. The electric, which was gaining at the finish, was not going within ten per cent as fast as it did in the earlier part of the race, showing that the consumption of current had been considerable. This was largely due to the heavy condition of the track. The two gasoline vehicles were far in the rear, but were going as fast, or faster, at the finish than in the early part of the race, and could have kept the same gait for fifty to a hundred miles more.

THE TRI-STATE FAIR AUTOMOBILE RACES.

The mile track at Guttenberg, N. J., was the scene of most interesting automobile races on September 8, which were held on the occasion of the Tri-State Fair. While most of the contests were important, the race between the machines of Mr. A. C. Bostwick, Mr. D. Wolfe Bishop, and Mr. A. L. Riker was the most valuable. The machines were run under the rules formulated by the Automobile Club of America. Mr. Bostwick's racing machine, which is of 24 horse power and weighs 3,000 pounds, was built by Panhard & Levassor, and was originally owned by M. Renée de Knyff, and has many times shown in France that it is capable of great speed. Mr. Bishop's machine was made by the same firm, but is slightly lighter, weighing 2,200 pounds and propelled by 16 horse power motors. The race for gasoline vehicles weighing over 1,000 pounds was 5 miles. Mr. Bostwick succeeded in covering the distance in 7 minutes and 43½ seconds. At the start of the ten mile "championship" race, Mr. Bostwick was first, Mr. Bishop second and Mr. Riker third. The Riker electric racing machine weighs 2,300 pounds. Mr. Riker gradually overtook and passed the others and finished the first lap many yards in the lead. His batteries then became short-circuited, and the machine came to a stop. Mr. Bostwick gained rapidly on his remaining competitor, and at the end of the 10 miles was more than 7 furlongs ahead, the last mile being made in 1 minute 27⅘ seconds. Mr. Bostwick also operated his Winton racing machine, shown in our engraving. The machine is of about 20 horse power. The following is a summary of the principal races:



MR. BOSTWICK IN HIS WINTON RACING MACHINE.



HIGH SPEED MADE BY MR. A. C. BOSTWICK IN HIS PANHARD & LEVASSOR RACING MACHINE, GUTTENBERG.

Gasoline vehicles, four wheels, American make; five miles—Won by T. Walsh, New York; F. Nagel, New York, second; A. C. Bostwick, New York, third. Time, 10:10⅘.

Gasoline vehicles, four wheel, of less than 1,000 pounds, any make; five miles—Won by C. J. Field, New York; F. T. Craven, New York, second; J. Lauveguez, New York, third; C. S. Henshaw, Brooklyn, fourth. Time, 11:43⅘.

Gasoline vehicles of more than 1,000 pounds, any make; five miles—Won by A. C. Bostwick, New York; D. Wolfe Bishop, Newport, second. Time, 7:43⅕.

Tricycles; five miles—Won by C. S. Henshaw, Brooklyn; J. Lauveguez, New York, second; Stanley R. Atkinson, New York, third. Time, 8:24⅘.

Electric vehicles, any kind; five miles—Walkover for A. L. Riker. Time not taken.

Steam vehicles, four wheels; five miles—won by W. J. Stewart, Newark; W. L. Hibbard, Bridgeport, second; S. T. Davis, New York, third; S. Houston, Newark, fourth. Time, 11:48.

"Championship," open to first and second prizewinners in the preceding events, except the first and that for tricycles; ten miles—won by A. C. Bostwick, New York; D. Wolfe Bishop, Newport, second. Time, 15:09⅕.

Disposal of Household Waste at Paris.

The question of the household waste of the city of Paris is treated by M. Vincey in a communication recently presented to the Society of Sanitary Engineers. The amount of household waste collected each day is about 3,200 cubic yards, or nearly 56 cubic yards per mile of street; the production increases from year to year in the proportion of $\frac{1}{50}$. In 1895 the 20 districts of the city produced about 1,020,000 cubic yards of waste, whose weight gave an average of 1,235 pounds per cubic yard; the annual weight was thus 570,035 tons, or an average of 1,562 tons per day, or 1·38 pounds per day and per person. The monthly production is variable, being considerably higher in winter than in summer; it is the same for the density. In 1895 the average for January was 1,450 pounds per cubic yard, and for September, 1,200 pounds; in that year the removal of the waste cost the city of Paris nearly $600,000, or $1.08 per ton. As the previous contract expired in July, 1899, a new one was made, and the expense has risen to over $800,000 annually.

MM. DESGREZ and Balthazard of Paris have been carrying out some elaborate experiments with the object of regenerating respirable air in a confined space, and have communicated the results of their researches to the Academy of Sciences. They have constructed a diving dress of aluminium which weighs in all about twenty-five pounds. Inside this dress they place a quantity of bioxide of sodium, and a diver wearing this apparatus can walk about for a considerable length of time under water, without coming to the surface to replenish his supply of air. It is claimed that the invention will be of inestimable value to persons engaged in mines, chemical industries, or to reach certain points surrounded by a poisonous atmosphere.

The Current Supplement.

The current SUPPLEMENT No. 1292 has a number of articles of remarkable interest. "The French Navy" is an elaborately illustrated article accompanied by many fine engravings and plans. "The Westinghouse Gas Engines" is a fully illustrated article showing the internal construction of the engines. "The Inaugural Address of Sir William Turner" is continued. "Roman and Gallo-Roman Flour Mills" is a most interesting article. "Mechanical and Technical Education in the United States," by Prof. C. F. Chandler, is also continued.

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RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

TROLLEY.—William A. Daggett, Vineland, N. J. The object of the invention is to provide a trolley which will have a yielding connection with the wire, whereby the usual pounding or jumping is avoided, thereby preventing the disconnection of the trolley and the consequent cutting out of the lights and power. To attain this end the inventor employs a spring-yielding connection between the frame in which the trolley rotates and the trolley-pole.

CIRCUIT-CONTROLLER.—Charles C. Webster, Asbury Park, N. J. This controller is designed to be used in connection with electrically-illuminated signs and can be readily adjusted or changed to direct a current to the lamps forming the respective letters of the sign in any desired order or combination. The arrangement consists of a series of fixed contacts connected with the lamps, and a rotary part provided with contact-lugs which complete the proper circuits when turned into engagement with the fixed contacts.

Mechanical Devices.

WATER-WHEEL.—John W. Taylor Manufacturing Company, Mt. Holly, N. J. The inventor's improvements pertain more particularly to very sensitive gates, so arranged exteriorly to the wheel and chute-box and so supported as to work without friction and wear with the parts inclosed by the gates. By a novel construction and arrangement of parts the gate is operated simultaneously in opposite directions lengthwise of the chute-boxes and wheels proper.

MACHINE FOR MAKING BRIQUETS FOR TESTING PURPOSES.—Thomas Miller, Jr., Manhattan, New York city. The machine forms briquets f om cement, plaster, or other material for testing purposes. These briquets are uniform in size, density and strength. By means of such briquets the breaking strain or crushing resistance of different brands of cement material, or the relative breaking stra ns and crushing resistance of different materials can readily be ascertained.

Railway Contrivances.

CAR-BRAKE LEVER. — Joseph C. Westerfield, Arlington, and Harry S. Chinnock, Jr., Belleville, N. J. In setting brakes hard, it is the usual practice to employ a hand-lever in the form of a wooden stick inserted in the spokes of the hand-wheel. This proceeding is somewhat dangerous, because the lever may slip. Such levers, moreover, are only too easily lost. The invention provides a brake-lever as a permanent attachment to the brake-rod, thus avoiding the dangers and difficulties mentioned. This lever is so connected with the rod that it may swing out of the way when not in use.

TRAIN-INDICATOR.—William M. Six and Oliver R. Daily, Lebanon, Ind. From the back of the case in which the indicator mechanism is contained, the operator can manipulate the indicating devices which are constructed and adapted to expose at the front of the case, the number of the train, the time when such train is due, and information whether or no the train is on time, and if late, to what extent.

BOTTLE.—George W. Vought, Queens, New York city. The bottle is of the non-refillable class. The inventor has devised a cheap and simple valve-mechanism which can be applied to bottles of the ordinary shape and which is designed to prevent the illegal re-filling of a bottle. The mechanism in question is so made that a wire cannot be inserted through the neck to unseat the valve.

COMBINED SAFETY ANDIRONS AND SCREEN. —Isaac W. Sullivan, Laxsonville, Tenn. The combined fire-screen and andirons are so arranged that each furnishes a support for the other, the andirons being adapted for lateral adjustment and for convenient detachment. The screen is of woven wire, and to its inner side, hooks are attached. A curved supporting-bar, adapted to rest upon the floor, is loosely engaged by the hooks. The front ends of the andirons are detachably supported on the horizontal portion of the bar.

Miscellaneous Inventions.

BURIAL-CASKET.—Philip Herbold, Jr., Galion, Ohio. This casket has a false bottom above, spaced apart from the bottom forming a recess for the cap or lid. A side is hinged to the bottom and is adjustable to positions to cover or to expose the opening to the cap or lid containing the recess.

PACKAGE FOR MEDICINES, ETC. — Luther E. Moore, Marietta, Georgia. Each section of the package is composed of an outer layer of coarse fibrous material, and an inner layer of a smooth firm surface with an intervening sheet of cement impervious to heat and sealing mixture. The mixture w ll penetrate the package as far as the outer layer, but will be checked by the cement, which confines the saturation to the outer coat, and reduces the degree of heat to which the contents of the package are subjected. For salts, powders, and granulations of an effervescent nature easily injured by atmospheric conditions, by heat, or by contact with acids or alkalies, this invention will be a perfect protector.

SOFT-TREAD HORSESHOE. — John Riley, Manhattan, New York city. This is a light shoe, strong and serviceable, and one that will prevent slipping on smooth surfaces. It may be used until worn away. The shoe comprises a metal portion, tapered pillars attached to it, and a pad engaging the pillars. Portions extend through the openings in the shoe. Side portions of the same are extended outward from the pad and provided with nail-holes.

LOGGING-TRUCK. — John Lindsey, Sandersville, Miss. This is a low two-wheeled cart having a concave bolster. A log rolled to a central position on the bolster will remain in place without the use of standards. Tongs engage the logs. There is an adjustable support for the tongs and a locking device for the support. The logs are drawn over the wheels upon the bolster. The truck has a wheeled axle and a widened tongue attached thereto A horizontal swinging bar is mounted at one end on the tongue near one side thereof. A log-gripping mechanism engages the log. There is a connection between this gripper and the bar, and a latch engages the free end of the bar to hold it.

APPAREL-SHIRT.—Samuel A. Israel, Manhattan, New York city. The invention makes an improvement in shirt-bosoms which are provided with flanges for holding detachable or false bosoms in place. The bosom-shirt has a retaining-flange provided with a slit or guideway at the lower end. A supplemental removable bosom is adapted to fit under the flange, and is provided with a tab which passes through the guideway.

NON-REFILLABLE BOTTLE. — Wilton A. and Thomas A. Hall, Fernandina, Fla. This bottle belongs to that class in which valves open outward. This permits the outflow of liquid and prevents an inflow. A valve formed of elastic material and puckered at the opening so as normally to close it, works with a plunger which serves to open it when the bottom is turned downward, but which will not act to open the valve when the bottle is in an upri ht position. This prevents its refilling.

PROCESS OF MAKING PHOSPHOR-TIN.—George Berthold, Great Falls, Mont. Phosphor-tin is made by subjecting a charge of tin, charcoal, and phosphorus, while held in a crucible and under the exclusion of air, to the action of heat in a furnace to cause the tin to melt and absorb a portion of the phosphorus. This forms the phosphor-tin to be used with copper to make castings of phosphor-bronze. There is no danger to the operator, as this method avoids to a great extent the formation of the obnoxious fumes which generally arise in the manufacture of phosphor-bronze.

WATER-CLOSET BOWL. — Charles Schiffelin, Manhattan, New York city. In this invention the overflow of the bowl is completely prevented. At the same time the bowl is kept from getting foul. All obnoxious sewer-gases are trapped. The mechanism consists of a water inlet, a main trap as an outlet for the bowl, a water-distributing channel in communication with the inlet, and an annular overflow-channel above the distributing-channel. All the parts are integral with the bowl.

GAGE FOR CROSSCUT-SAWS.—Joseph Morin, Seattle, Wash. A former invention of Mr. Morin's has been improved upon in this contrivance which provides a device in connection with saw-gages for measuring and testing the raker or chisel teeth of crosscut-saws in swaging the saws. Also a device in connection with a saw-gage for holding a chilled metal plate having a slot large enough to admit a raker-tooth immovable with reference to the body of the gage, and below the points of the cutting-teeth, making the points of each raker-tooth the same length; and also a device for holding a file fixed with its face at an accurate angle with the blade of the saw for jointing the cutting-teeth. A smooth frictionless surface in a perfect plane rests on the cutting teeth when gaging raker-teeth for swaging, and a transverse section of this plane is at right angles with the saw-blade when swaging.

BREAD-RAISING APPARATUS.—John D. Bell, Arcadia, Kans. On the main box is a hinged lid having an aperture. This box is removably seated on a legged stand. There is a smaller raising-box with a lid thereon, and a removable partition in the raising-box. Ledges on the main box and raising-box support the latter centrally within the main box. A deflector-plate is in the main box below the raising-box and over an aperture in the bottom of the former. A casing hung from the bottom of the main box incloses the aperture, wherein is placed a lamp adapted to transmit heat into the air-space between the boxes. A gas-jet or an electric heating medium can also be used.

Designs.

BELT.—Louis Sanders, Brooklyn, New York city. The novel feature of the design is a panel embossed and offset from the waist-band.

BABY-COMFORTER. — Christian W. Meinecke, Jersey City, N. J. The device consists of a nipple, the base of which is below a shield. The base below the shield has an annular rib formation at the upper end of a pad, the nipple constituting a portion of the pad.

BOTTLE.—Moritz Rheinauer, Manhattan, New York city. The bottle consists of two connected V-shaped members provided with a common threaded neck.

ANTI-RATTLER.—Fenton E. Judson, Antigo, Wis. This patentee gives a new shape to the bearing block employed in connection with wire anti-rattlers to obtain a better connection with the spring wire and a more efficient pressure on the thill.

Note.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

Blue Print Making, Embracing Directions for Constructing the Printing Frame, Preparing the Paper and Making Prints of Various Kinds. New York: David Williams Company. 1900. 16mo. Pp. 28. Price 25 cents.

Thoroughly practical and tested directions for making blue print paper will certainly prove of value to architects and engineers, who require the use of blue print paper.

Mining Laws of the United States of Mexico. Mexico City: F. P. Hoeck & Company. 1899. 8vo. Price $1 United States currency.

All those who contemplate having any mining business in Mexico should obtain a copy of these laws. They are printed in Spanish on one side of the page and in English on the other. This will tend to prevent mistakes.

Progressive Carpentry. By D. H. Maloy. New York: David Williams Company. 1900. 16mo. Pp. 89. Price $1.

The author states that the work of preparation for this book began in 1860, and the first edition appeared in 1890. It presents his new system of constructive carpentry and will undoubtedly be of use to builders.

Business and Personal.

Marine Iron Works. Chicago. Catalogue free.

For mining engines. J. S. Mundy, Newark, N. J.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., Spring and Varick Sts., N. Y.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7970) G. N. S. asks: Would cotton-covered wire do for the secondary coil described in Supplement, No. 160? Of course silk is a better insulator, but would the difference amount to very much? By answering oblige a constant reader. A. The reason silk covered wire is used in an induction coil is that the covering is thinner and takes less room. The object is to have as many turns as possible in the space given to the secondary.

(7971) W. E. F. asks: How can I make the best and cheapest lining to use in a reservoir dug in a side hill of sand and gravel, to hold about 20,000 gallons, not over 3½ feet deep? Will freezing injure it if empty in winter? A. The cheapest way to line a shallow reservoir is to tamp a clay and sand puddle all over the bottom and sides, not less than one foot thick. It can be made in two layers of half a foot each to great advantage in preventing seepage seams by lapping the work. The sand and clay should be mixed in equal parts, stiff and well rammed. When finished, the whole surface should be covered with clean gravel. Freezing will not injure it.

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SEPTEMBER 25, 1900,

AND EACH BEARING THAT DATE.

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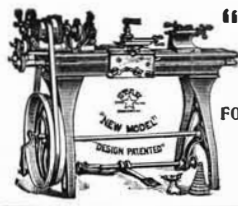

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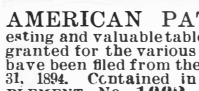

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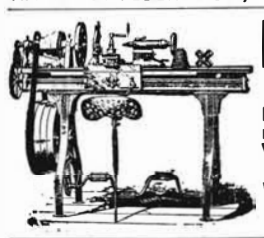

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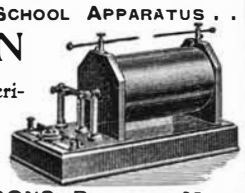

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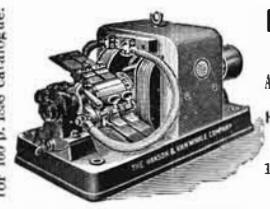

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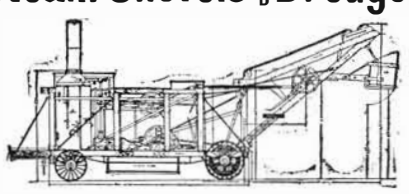

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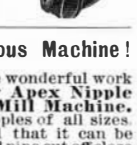

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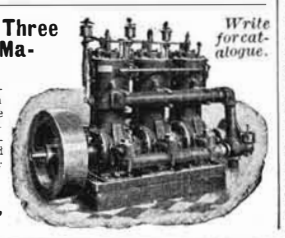

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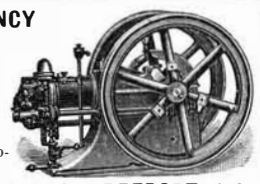

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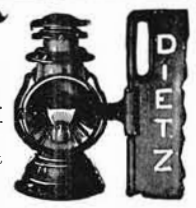

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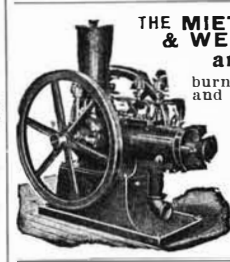

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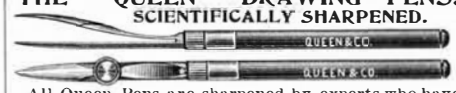

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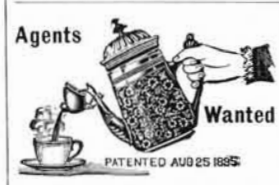

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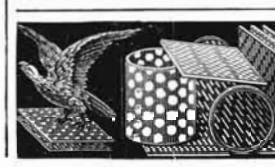

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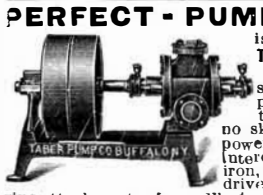

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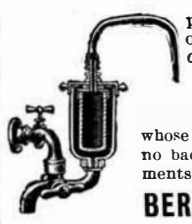

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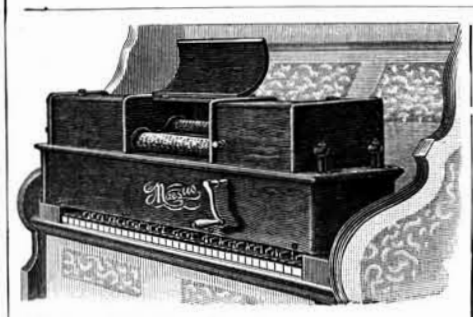

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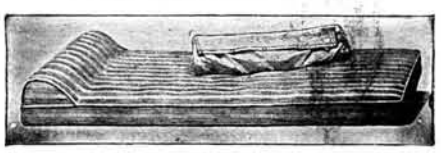

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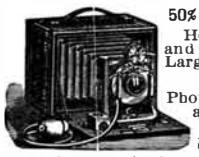

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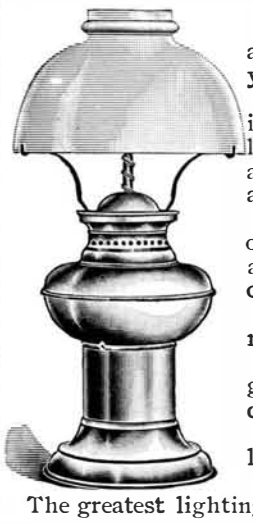

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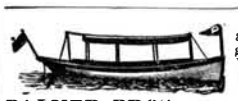

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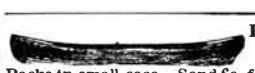

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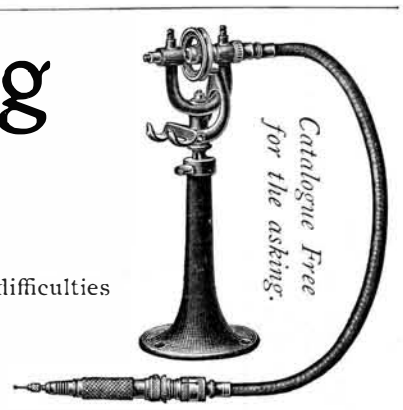

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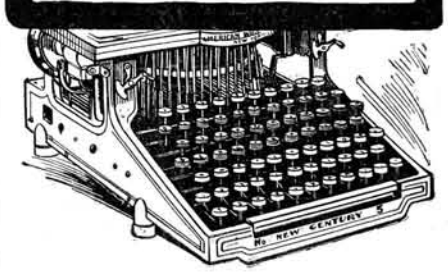

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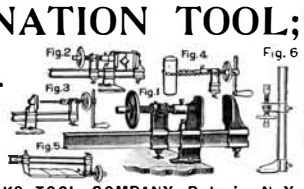

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